# THE JOURNAL OF GAS LIGHTING
## WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVII. No. 1467.] LONDON, JUNE 23, 1891. [43RD YEAR. Price 6d.



**WOLSTON'S** Paste and Ready Mixed for Use.
Guaranteed Free from Adulteration. **TORBAY PAINTS.**
FOR GASHOLDERS, &c., &c.
The Original "Torbay Paints" As supplied during the present and many preceding years to the LONDON GASLIGHT & COKE COMPANY.
*Special Quotations to Gas Companies.*
TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
Works: DARTMOUTH, DEVON.

— ESTABLISHED 1830. —
**PARKER & LESTER,**
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
*Oxide Paints, Oils, and General Stores for Gas and Water Works.*
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.
Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
*See Advertisement, p. 1274.*

**CEMENT**
**EARLE'S**
BEST
**Portland Cement**
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

J. UNGAR & CO.,
Manufacturers & Patentees of every Description of
IMPROVED LAMPS
FOR
Streets, Markets, Shops, &c.
WHOLESALE DEPOT: 52, COMMERCIAL ST., LONDON, E.
*We specially solicit Government and Local Board Contracts for General Lighting.*

MELDRUM'S PATENT SELF-CONTAINED
**Dust Fuel Furnace**
Burns any kind of WASTE FUEL to advantage.
OVER 300 SUCCESSFULLY WORKING.
FOR PARTICULARS APPLY TO
**MELDRUM BROS.,**
Atlantic Works, 13, City Road,
**MANCHESTER.**
Telegrams: "MELDRUM, MANCHESTER." National Telephone: No. 1674.

# DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

## GASHOLDER & BOILER WORKS,

**WEST BROMWICH, NEAR BIRMINGHAM**

(ESTABLISHED 1765).

## MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

*PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,*

**Wrought-Iron Roofs, Bridges, Girders, &c.,**

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

---

# EDWARD COCKEY & SONS, LIMITED,

## ENGINEERS & CONTRACTORS FOR GAS-WORKS.

TELEGRAPHIC ADDRESS: "COCKEYS FROME."

THE IRON-WORKS,
FROME.

Messrs. COCKEY desire to draw the attention of Gas Engineers and Managers to their new form of GAS WASHER, which, by a recent patent, converts their HORIZONTAL Washer into one of a VERTICAL form.

The principle is the same as in the horizontal one, which has now been before the profession for a number of years, and where adopted is giving unqualified satisfaction.

The Washer is entirely automatic in its action, and does not therefore need any motive power—an advantage which will be apparent to all.

It is made in all sizes, from 25,000 TO 3,000,000 FEET PER DAY; and Messrs. COCKEY invite inquiries, which shall have early attention.

*March*, 1891.

PRICES ON APPLICATION TO THE SOLE MAKERS.

## THE IRON-WORKS, FROME SELWOOD, SOMERSET.

---

*HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.*

**—11 MEDALS.—**

MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

## WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON:
108, Southwark Street.

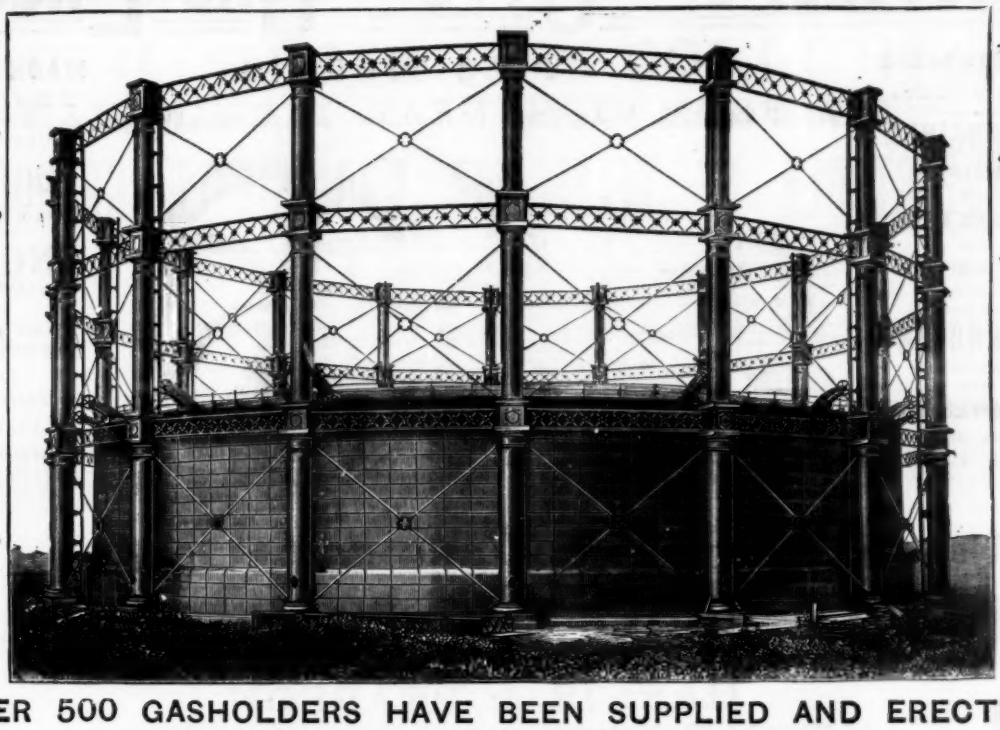
BIRMINGHAM:
114, Colmore Row.

LEEDS:
6, Mark Lane, New Briggate.

# THOMAS PIGGOTT & CO., BIRMINGHAM.

LONDON OFFICE: ST. THOMAS APOSTLE, E.C.

GAS PLANTS, BOILERS, ENGINES, PUMPS, ROOFS, RETORT FITTINGS, ETC.



TELEGRAPHIC ADDRESS: ATLAS, BIRMINGHAM.

WELDED & RIVETED FOUL PIPES, MAINS, RETORT-LIDS, WROT & CAST TANKS, PURIFIERS.

## OVER 500 GASHOLDERS HAVE BEEN SUPPLIED AND ERECTED,

INCLUDING THOSE SUPPLIED TO THE FOLLOWING GAS COMPANIES AND CORPORATIONS:

| | | | | | | |
|---|---|---|---|---|---|---|
| BATH. | BOLTON. | BRISTOL. | CHELTENHAM. | LEAMINGTON. | PRESTON. | SHEFFIELD. |
| BELFAST. | BOMBAY. | BRISBANE. | HARTLEPOOL. | LIVERPOOL. | READING. | STOCKHOLM. |
| BECKTON. | BRADFORD. | CARDIFF. | LEEDS. | NOTTINGHAM. | RIO GRANDE. | SYDNEY. |
| BIRMINGHAM. | BRIGHTON. | COVENTRY. | LEICESTER. | OLDHAM. | SOUTH METRON. | VIENNA. |

# GAS COAL.

BEST

## REAL OLD SILKSTONE GAS COAL,

Address, THE STRAFFORD COLLIERIES COMPANY,

Near BARNSLEY, SOUTH YORKSHIRE.

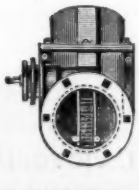
# NEWTON, CHAMBERS, & CO., LIMITED

## THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

SLIDE VALVES, WITH RACK & PINION, OR Internal or External SCREWS, of all Sizes.

GASHOLDERS, AND Gasholder Tanks.



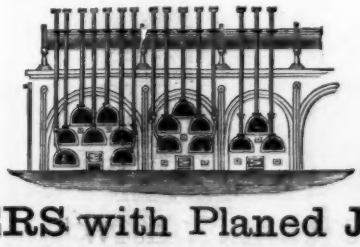
CAST-IRON RETORTS,

RETORT-BED FITTINGS,

*And Retort-House Appliances*

of every description.

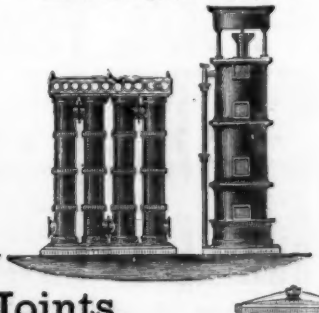
Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



WROUGHT AND CAST IRON

CONDENSERS, SCRUBBERS, & WASHERS,

TAR AND LIQUOR PUMPS, &c.



PATENT

CENTRE VALVES

for working Purifiers.

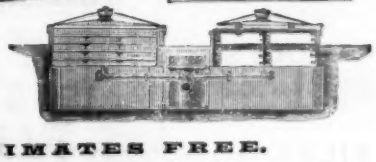
Also Bye-Pass & Stop Valves

PURIFIERS with Planed Joints,

HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS,

WOOD GRIDS.

CAST AND WROUGHT IRON TANKS AND CISTERNS.



DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

## GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE,

PRICES ON APPLICATION TO THE SOLE MAKERS.

# CROSSLEY'S "OTTO" GAS-ENGINE.

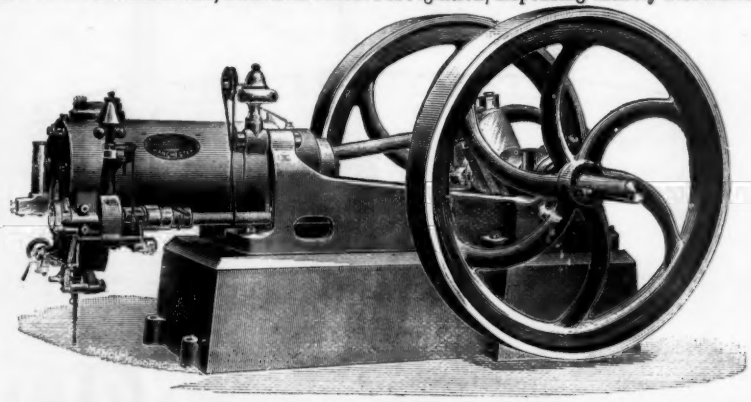
## 100 Prize Medals.

MADE in SIZES
*2-Man to 100-HP.*

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
SHONE SEWAGE
SYSTEM, LUCIGEN
LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
*2-Man to 100-HP.*

VERTICAL
AND
HORIZONTAL
TYPES.

ENGINES
*COMBINED*
WITH
HOISTS, PUMPS,
DYNAMOS, &c., &c.

*Largely used for*
*EXHAUSTING,*
*PUMPING,*
*COKE CRUSHING,*
*ELECTRIC LIGHTING,*
&c., &c.

Over 31,000 "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

LONDON,
LIVERPOOL,
GLASGOW,
NEWCASTLE,
BIRMINGHAM,
HULL.

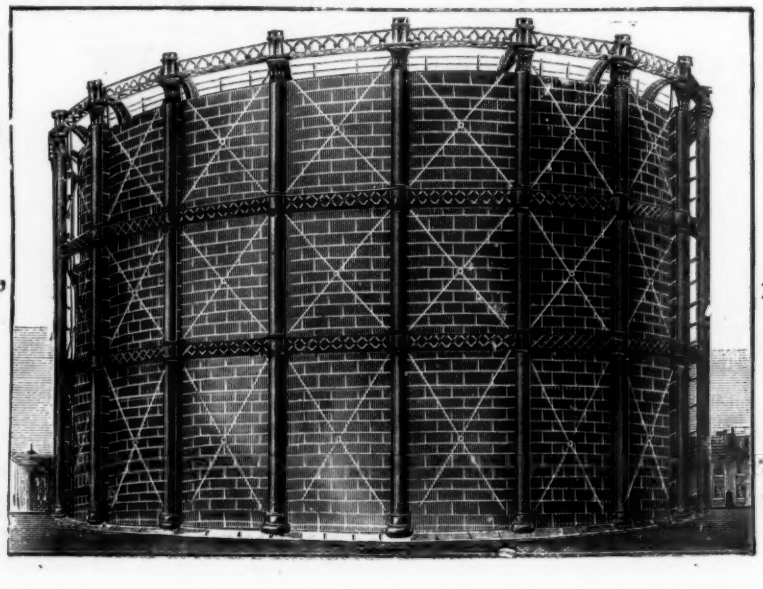
HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

# THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE,

MAKERS OF GAS HOLDERS & GAS PLANT,

PURIFIERS, SCRUBBERS, CONDENSERS, WASHERS, TANKS, VALVES,
PIPES, LAMP PILLARS, RETORT-FITTINGS, ETC.

ALSO ALL KINDS OF
STRUCTURAL IRON
AND STEEL WORK,
BRIDGES,
ROOFS,
PIERS, ETC.



WORKS & HEAD OFFICE:
TIPTON,
STAFFORDSHIRE.

LONDON OFFICE:
11, VICTORIA ST.,
WESTMINSTER.

TELEGRAPHIC ADDRESSES:
"HORSELEY, TIPTON."
"GALILEO, LONDON."

## JOSEPH CLIFF & SONS,

INCORPORATED IN THE LEEDS FIRE-CLAY COMPANY, Ltd.,

WORTLEY, LEEDS.

LONDON Offices & Depôts:
*Baltic Wharf, Waterloo Bridge.*

WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

LIVERPOOL:
*16, Lightbody Street.*

LEEDS:
*Queen Street.*

**MACHINE-MADE RETORTS**

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

**Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.**

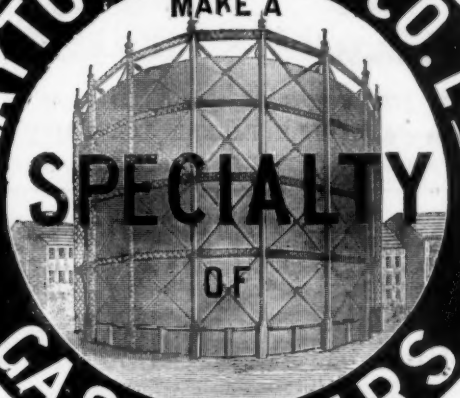
ESTABLISHED MORE THAN A QUARTER OF A CENTURY

WORKS HUNSLET, LEEDS

LONDON OFFICE: 60, QUEEN VICTORIA STREET E.C.

## CLAYTON SON & CO. LTD.

MAKE A



SPECIALTY OF GASHOLDERS

AND MAKERS OF

REG. TELEGRAPHIC ADDRESS: "GAS LEEDS"

GAS PLANT OF EVERY DESCRIPTION.

# R. & J. DEMPSTER,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER,

MAKERS AND ERECTORS OF

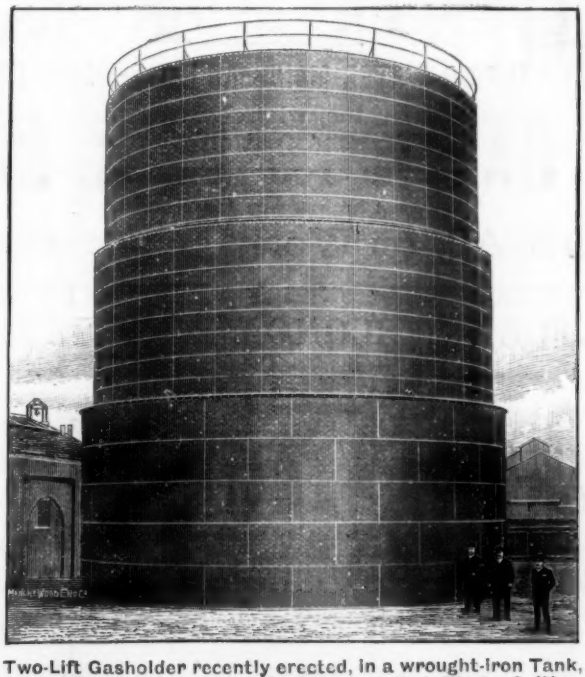
## PATENT COLUMNLESS GASHOLDERS.

*Telegraphic Address: "SCRUBBER MANCHESTER."*

**TOTAL WEIGHT REDUCED**
from 30 per cent. to 50 per cent.

**TRANSPORT AND ERECTION REDUCED**
to the same extent; and in cases where gasholders are shipped abroad to places difficult of access, this represents a very large amount of money.

**TANK CONSTRUCTION SIMPLIFIED.**
The Tank wall (of whatever construction) is a regular cylinder. There are no piers needed, and all expensive foundation stones for the base of columns or standards are dispensed with.



Two-Lift Gasholder recently erected, in a wrought-iron Tank, for the Birmingham Oxygen Company, at their Works, Saltley, Birmingham. The bottom of the Tank is fixed level with the ground, upon a concrete foundation.

**COST OF PAINTING SAVED**
for the Columns and Girders.

**TILTING UTTERLY IMPOSSIBLE;**
And as there are fewer parts, there is less liability for the Gasholder to get out of order in working.

**STABILITY UNDER WIND PRESSURE**
of a Gasholder constructed upon this system is at least equal to, and from experiments and calculations made is far in excess of, that of a Holder of the same dimensions guided by the elaborate guide framing at present in use.

The removal of heavy guide carriages and rollers from the top curbs considerably lowers the centre of gravity of the structure, and dispenses with the extra strength of sheeting necessary to carry these at the points where they are attached to the gasholder.

The plan adapts itself to telescoping to any reasonable extent, and enables very shallow holders or lifts to be employed with perfect stability.

**FOR FURTHER PARTICULARS AND ESTIMATES, APPLY TO THE ABOVE.**

## JOHN HALL & CO.,

**STOURBRIDGE,**

**MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,**

**AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.**

**RETORTS CAREFULLY PACKED FOR SHIPMENT.**

A STOCK OF DIFFERENT SHAPES ON HAND.

## GAS AND WATER PIPES

AND

## CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

## CLAY CROSS COMPANY,

## CHESTERFIELD.

| TRADE | TELEGRAMS: | LONDON AGENTS: |
|---|---|---|
| C X O | "JACKSON" | BECK & Co., |
| MARK. | CLAY CROSS. | 130, GT. SUFFOLK ST., S.E. |

## SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

## DR. FELDMANN'S APPARATUS.

**The most successful and approved Apparatus known up to the present time.**

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES APPLY TO THE

Sole Agents and Manufacturers,

## GODDARD, MASSEY, & WARNER,

ENGINEERS,

**NOTTINGHAM.**

The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

| | | |
|---|---|---|
| ILKESTON. | BURY. | CHORLEY. |
| WIDNES. | BRIGHOUSE. | WHITEHAVEN. |
| HALIFAX. | MARKET HARBRO'. | CHESTER. |
| ALTRINCHAM. | PRESCOT. | SOUTH SHIELDS. |
| DENTON. | SOWERBY BRIDGE. | LEEK. |
| ST. ALBANS. | LEICESTER. | IPSWICH. |
| DUKINFIELD. | DARWEN. | BOURNEMOUTH. |
| NORTHWICH. | NELSON. | SALFORD. |
| HUDDERSFIELD. | ORMSKIRK. | LUTON. |
| | | HAMPTON COURT. |

## RUSCOE'S PATENT MACHINE

**FOR DRILLING AND TAPPING WATER-MAINS AND GAS-MAINS UNDER PRESSURE.**

Patent Saddle Back and Drilling Apparatus, whereby Gas and Water Mains can have 2-in., 3-in., 4-in., 5-in., and 6-in. Branches put on without loss of Water or Gas.

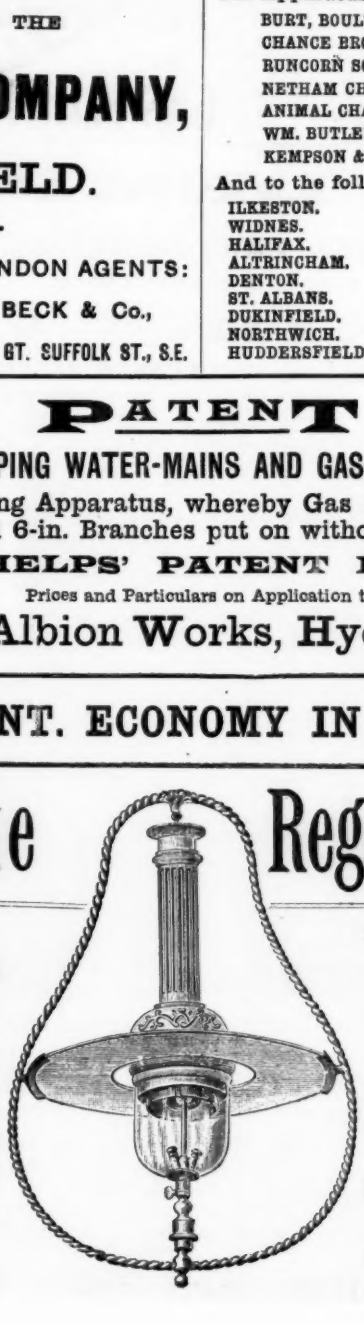
**Sole Maker of HELPS' PATENT PIPE EXTRACTOR.**

Prices and Particulars on Application to

## JOHN RUSCOE, Albion Works, Hyde, near Manchester.

## SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

# The Schülke Regenerative Lamp



FOR

**DOMESTIC AND EXTERNAL LIGHTING.**

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

**PURE WHITE & PERFECTLY STEADY LIGHT,**

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

## SCHÜLKE GAS-LAMP Co.

LIMITED,

**20, HIGH HOLBORN,**

LONDON, W.C.,

Where Price Lists and full particulars may be obtained.

# KIRKHAM, HULETT, & CHANDLER, LIMITED.

Mr. SIDNEY HERSEY, Managing Director.] ADDRESS AT FOOT. [Mr. J. CHANDLER, Engineer.]

## 416 Patent "Standard" Washer-Scrubbers,

**Equal to a Daily Capacity of 374,700,000 Cubic Feet of Gas,**

*Erected and in course of construction at present date, amongst them being the following, viz.:—*

**(All new machines are supplied with improved wooden washing devices—"Bundles"—which can also be fitted to old Washers)**

| | Capacity. Cubic feet per day. |
|---|---|
| Alfrincham .. .. | 600,000 |
| Adelaide .. .. .. | 600,000 |
| Aldershot .. .. .. | 200,000 |
| Allegheny, U.S.A. .. | 1,000,000 |
| Ashton-under-Lyne.. | 1,250,000 |
| Amsterdam .. .. | 1,500,000 |
| „ .. .. | 1,500,000 |
| Annaberg .. .. .. | 200,000 |
| Arcachon .. .. .. | 100,000 |
| Animal Charcoal Co. | 200,000 |
| Altoona, U.S.A. .. | 350,000 |
| Buxton .. .. .. | 250,000 |
| Bradford .. .. .. | 1,000,000 |
| „ .. .. .. | 1,250,000 |
| „ .. .. .. | 1,250,000 |
| „ .. .. .. | 1,250,000 |
| „ .. .. .. | 1,000,000 |
| „ .. .. .. | 1,000,000 |
| „ .. .. .. | 3,000,000 |
| Bremen .. .. .. | 150,000 |
| Baltimore, U.S.A. .. | 1,000,000 |
| „ .. | 1,000,000 |
| „ .. | 1,000,000 |
| Balmain, N.S.W. .. | 125,000 |
| Bishops Stortford .. | 150,000 |
| Blackpool .. .. .. | 400,000 |
| Brussels .. .. .. | 1,250,000 |
| „ .. .. .. | 1,250,000 |
| „ .. .. .. | 750,000 |
| „ .. .. .. | 1,250,000 |
| Banbury .. .. .. | 250,000 |
| Birmingham .. .. | 5,000,000 |
| Birkenhead .. .. | 2,500,000 |
| Blackburn .. .. .. | 1,500,000 |
| Bochum .. .. .. | 600,000 |
| Buratisland .. .. | 250,000 |
| Boston, U.S.A. .. | 2,000,000 |
| Brisbane .. .. .. | 1,500,000 |
| „ .. .. .. | 300,000 |
| Burton-on-Trent .. | 1,500,000 |
| Barcelona .. .. .. | 350,000 |
| Barking .. .. .. | 100,000 |
| Baerlien & Co. .. | 20,000 |
| „ .. .. | 420,000 |
| Bombay .. .. .. | 700,000 |
| Buffalo, U.S.A. .. | 550,000 |
| „ .. .. | 500,000 |
| Brooklim, U.S.A. .. | 300,000 |
| Bergen .. .. .. | 250,000 |
| Berlin .. .. .. | 150,000 |
| Bournemouth .. .. | 1,000,000 |
| Bridgeport, U.S.A. .. | 500,000 |
| Brunswick .. .. | 300,000 |
| Beck & Co., St. Louis | 100,000 |
| Barmen Rittershausen | 600,000 |
| Bexhill .. .. .. | 125,000 |
| Brooklyn, U.S.A. .. | 1,000,000 |
| „ .. | 1,000,000 |
| Brunner, Mond, & Co. | 400,000 |
| Cheltenham .. .. | 2,000,000 |
| Cannes .. .. .. | 200,000 |
| Croydon .. .. .. | 1,500,000 |
| Copenhagen .. .. | 200,000 |
| Clevedon .. .. .. | 200,000 |
| Columbus, U.S.A. .. | 500,000 |
| Cincinnati, U.S.A. .. | 1,500,000 |
| „ .. | 1,500,000 |
| Chicago, U.S.A. .. | 3,000,000 |
| „ .. | 1,000,000 |
| „ .. | 1,000,000 |
| Chemnitz .. .. .. | 1,000,000 |
| Crewe .. .. .. | 1,250,000 |
| Colonial Gas-Works Co. | 100,000 |
| Cadiz .. .. .. | 300,000 |
| Charottenberg .. .. | 600,000 |
| Dudley .. .. .. | 750,000 |
| Driffield .. .. .. | 100,000 |
| Dukinfield .. .. | 500,000 |
| Dover .. .. .. | 750,000 |
| „ .. .. .. | 1,000,000 |
| Deal .. .. .. .. | 200,000 |
| Derby .. .. .. | 1,500,000 |

| | Capacity. Cubic feet per day. |
|---|---|
| Dublin .. .. .. | 3,600,000 |
| Dowlais .. .. .. | 100,000 |
| Douai .. .. .. .. | 500,000 |
| Denton .. .. .. | 500,000 |
| Derby, U.S.A. .. .. | 350,000 |
| Denver, „ .. .. | 500,000 |
| „ „ .. .. | 1,000,000 |
| Düsselldorf .. .. | 750,000 |
| „ .. .. | 500,000 |
| Dumfries .. .. .. | 250,000 |
| Dunedin, N.Z. .. .. | 400,000 |
| Darlington .. .. .. | 1,250,000 |
| Detroit, U.S.A. .. .. | 750,000 |
| Edinburgh .. .. | 1,500,000 |
| „ .. .. | 2,000,000 |
| Enfield .. .. .. | 300,000 |
| Essen .. .. .. .. | 300,000 |
| Elbing .. .. .. | 150,000 |
| Falmouth .. .. .. | 150,000 |
| Frankfort .. .. .. | 300,000 |
| Farnworth .. .. .. | 400,000 |
| Fenton .. .. .. | 400,000 |
| Friedenshütte .. .. | 500,000 |
| Fürth .. .. .. .. | 400,000 |
| Freiburg .. .. .. | 200,000 |
| Goole .. .. .. .. | 250,000 |
| Glossop .. .. .. | 300,000 |
| Guildford .. .. .. | 300,000 |
| Gloucester .. .. .. | 1,250,000 |
| Gera .. .. .. .. | 300,000 |
| Grafton, N.S.W. .. | 100,000 |
| Grieg .. .. .. .. | 300,000 |
| Georgetown, U.S.A. .. | 250,000 |
| Gluckauf .. .. .. | 200,000 |
| Heywood .. .. .. | 600,000 |
| Holywood .. .. .. | 125,000 |
| Huy .. .. .. .. | 70,000 |
| Harrow .. .. .. | 250,000 |
| Harrogate .. .. .. | 250,000 |
| Halstead .. .. .. | 150,000 |
| Heilbronn .. .. .. | 200,000 |
| Havanna, Cuba .. .. | 750,000 |
| Hastings .. .. .. | 1,500,000 |
| Huddersfield .. .. | 300,000 |
| „ .. .. | 750,000 |
| „ .. .. | 1,500,000 |
| Hof .. .. .. .. | 200,000 |
| Hampton Wick .. .. | 500,000 |
| Heckmondwike .. .. | 500,000 |
| Haverfordwest .. .. | 100,000 |
| Halifax, N.S. .. .. | 350,000 |
| Hamm .. .. .. | 200,000 |
| Halle .. .. .. .. | 400,000 |
| Heidelberg .. .. .. | 300,000 |
| Hartford, U.S.A. .. | 1,000,000 |
| Ilkeston .. .. .. | 300,000 |
| Inverness .. .. .. | 250,000 |
| Ilkley .. .. .. .. | 200,000 |
| Ilford .. .. .. .. | 100,000 |
| Kingston-on-Hull .. | 400,000 |
| Kidderminster .. .. | 750,000 |
| Kidsgrove .. .. .. | 100,000 |
| Königsberg .. .. | 1,000,000 |
| King's Lynn .. .. | 300,000 |

**LONDON:—**

| | | Capacity. Cubic feet per day. |
|---|---|---|
| The Gaslight and Coke Co.:— | | |
| Beckton .. .. | | 1,250,000 |
| „ .. .. | | 1,250,000 |
| „ .. .. | | 1,250,000 |
| „ .. .. | | 1,250,000 |
| „ .. .. | | 1,250,000 |
| „ .. .. | | 2,500,000 |
| „ .. .. | | 2,500,000 |
| Silvertown .. | | 1,000,000 |
| Bromley .. .. | | 2,000,000 |
| „ .. .. | | 1,500,000 |
| „ .. .. | | 1,500,000 |
| „ .. .. | | 1,500,000 |
| „ .. .. | | 2,000,000 |
| „ .. .. | | 1,500,000 |
| Shoreditch .. .. | | 2,500,000 |
| LONDON—*Continued.* | | |
| Pancras .. .. | | 1,500,000 |
| „ .. .. | | 1,500,000 |
| Pimlico .. .. | | 2,000,000 |
| Nine Elms .. | (2) | 3,000,000 |
| Kensal Green | (2) | 3,000,000 |
| South Metropolitan Co.:— | | |
| Greenwich .. .. | | 3,000,000 |
| Woolwich .. .. | | 400,000 |
| Vauxhall .. .. | | 3,000,000 |
| „ .. .. | | 3,000,000 |
| Lea Bridge .. .. | | 300,000 |
| West Ham .. .. | | 1,500,000 |
| „ .. .. | | 3,000,000 |
| Leeds .. .. .. .. | | 2,000,000 |
| „ .. .. .. .. | | 3,000,000 |
| „ .. .. .. .. | | 3,000,000 |
| „ .. .. .. .. | | 3,000,000 |
| „ .. .. .. .. | | 3,000,000 |
| „ .. .. .. .. | | 2,000,000 |
| Leominster .. .. .. | | 150,000 |
| Leiden .. .. .. .. | | 560,000 |
| „ .. .. .. .. | | 600,000 |
| Liverpool .. .. .. | | 2,000,000 |
| „ .. .. .. | | 2,000,000 |
| „ .. .. .. | | 2,000,000 |
| „ .. .. .. | | 2,000,000 |
| „ .. .. .. | | 2,000,000 |
| „ .. .. | (3) | 3,000,000 |
| Lincoln .. .. .. .. | | 1,000,000 |
| „ .. .. .. .. | | 600,000 |
| Lowell, U.S.A. .. .. | | 1,000,000 |
| Laclede, „ .. .. | | 1,000,000 |
| Louisville „ .. .. | | 1,500,000 |
| Long Eaton .. .. .. | | 500,000 |
| Lille .. .. .. .. | | 900,000 |
| „ .. .. .. .. | | 450,000 |
| „ .. .. .. .. | | 750,000 |
| „ .. .. .. .. | | 250,000 |
| „ .. .. .. .. | | 250,000 |
| Luckenwalde .. .. | | 330,000 |
| Liegwitz .. .. .. | | 300,000 |
| Lincoln, U.S.A .. .. | | 250,000 |
| Lawrence, „ .. .. | | 500,000 |
| Lynn, „ .. .. | | 300,000 |
| Lyons .. .. .. .. | | 1,500,000 |
| Maidstone .. .. .. | | 1,000,000 |
| Marseilles .. .. .. | | 1,500,000 |
| „ .. .. .. | | 1,500,000 |
| Mons .. .. .. .. | | 500,000 |
| Malines .. .. .. | | 250,000 |
| Melbourne .. .. .. | | 1,500,000 |
| „ .. .. .. | | 1,500,000 |
| „ .. .. .. | | 1,500,000 |
| „ .. .. .. | | 1,500,000 |
| „ .. .. .. | | 1,500,000 |
| Manchester .. .. .. | | 2,500,000 |
| Middleton .. .. .. | | 400,000 |
| Manley, N.S.W. .. .. | | 100,000 |
| Minneapolis, U.S.A. .. | | 750,000 |
| Magdeburg .. .. .. | | 3 0,000 |
| Memphis, U.S.A. .. | | 750,000 |
| Nottingham .. .. .. | | 1,250,000 |
| „ .. .. .. | | 2,500,000 |
| „ .. .. .. | | 2,500,000 |
| „ .. .. .. | | 2,000,000 |
| „ .. .. .. | | 1,500,000 |
| „ .. .. .. | | 2,000,000 |
| Newport, U.S.A. .. .. | | 430,000 |
| Newmarket .. .. .. | | 150,000 |
| Newark, U.S.A. .. .. | | 680,000 |
| Northfleet .. .. .. | | 200,000 |
| New York, U.S.A. .. | | 2,000,000 |
| Nice .. .. .. .. | | 600,000 |
| Newcastle, N.S.W. .. | | 200,000 |
| Numea, „ .. | | 100,000 |
| Namur .. .. .. .. | | 250,000 |
| Newark .. .. .. .. | | 350,000 |
| Nassau, U.S.A. .. .. | | 1,000,000 |
| Oldbury .. .. .. | | 500,000 |
| Otley .. .. .. .. | | 200,000 |
| Oswestry .. .. .. | | 250,000 |

| | Capacity. Cubic feet per day. |
|---|---|
| Ober Schlesian .. | 1,500,000 |
| Otto & Co.'s Coke Works | 1,500,000 |
| Plymouth .. .. .. | 2,000,000 |
| Parramatta, N.S.W. | 100,000 |
| Prescot .. .. .. | 150,000 |
| Providence, U.S.A. .. | 750,000 |
| „ „ .. | 750,000 |
| Plauen .. .. .. | 300,000 |
| „ .. .. .. | 300,000 |
| Portsmouth .. .. | 2,500,000 |
| „ .. .. | 2,500,000 |
| Pittsburg, U.S.A. .. | 1,500,000 |
| Portland, „ .. | 560,000 |
| Pawtucket „ .. | 500,000 |
| Quebec .. .. .. | 250,000 |
| Radcliffe .. .. .. | 750,000 |
| Rouen .. .. .. | 250,000 |
| Ramsgate .. .. .. | 1,000,000 |
| Reigate .. .. .. | 200,000 |
| Richmond, U.S.A. .. | 250,000 |
| Roxbury, „ .. | 500,000 |
| Runcorn Soap Co. .. | 20,000 |
| Rockhampton, N.S.W. | 125,000 |
| Richmond .. .. | 1,500,000 |
| Reading .. .. .. | 2,000,000 |
| Reichenbach .. .. | 200,000 |
| Salford .. .. .. | 1,750,000 |
| „ .. .. .. | 1,750,000 |
| „ .. .. .. | 1,750,000 |
| Smethwick .. .. | 750,000 |
| Sydney, N.S.W. .. | 1,000,000 |
| „ .. .. | 1,000,000 |
| „ .. .. | 2,500,000 |
| „ .. .. | 50,000 |
| „ .. .. | 50,000 |
| Sunderland .. .. | 1,500,000 |
| St. Joseph's, U.S.A. .. | 250,000 |
| Spa .. .. .. .. | 100,000 |
| Sevenoaks .. .. .. | 300,000 |
| St. Petersburg .. .. | 2,000,000 |
| „ .. .. | 1,500,000 |
| St. Louis, U.S.A. .. | 2,000,000 |
| „ .. | 2,000,000 |
| „ .. | 1,000,000 |
| Silesian Coal Co. .. | 600,000 |
| San Francisco, U.S.A. | 2,000,000 |
| „ | 2,000,000 |
| Sheepbridge Coal Co. | 40,000 |
| Stettin .. .. .. | 200,000 |
| Singapore .. .. .. | 300,000 |
| Sutton .. .. .. | 500,000 |
| Tonbridge .. .. .. | 150,000 |
| Tipton .. .. .. | 400,000 |
| Tottenham .. .. | 1,000,000 |
| Toledo, U.S.A. .. .. | 750,000 |
| Toronto .. .. .. | 1,000,000 |
| Uxbridge .. .. .. | 300,000 |
| Valparaiso .. .. .. | 500,000 |
| West Bromwich .. | 1,000,000 |
| Willenhall .. .. .. | 250,000 |
| Weston-super-Mare .. | 500,000 |
| Waltham .. .. .. | 150,000 |
| Wormwood Scrubbs .. | 300,000 |
| Williamsburg, U.S.A. | 600,000 |
| „ „ | 600,000 |
| Wellington .. .. .. | 150,000 |
| Warwick .. .. .. | 300,000 |
| Wheeling, U.S.A. .. | 500,000 |
| Walker .. .. .. | 300,000 |
| Westgate .. .. .. | 100,000 |
| Wilmington, U.S.A. .. | 500,000 |
| Windsor, N.S.W. .. | 100,000 |
| Wolverton .. .. .. | 100,000 |
| Wellington, N.Z. .. | 250,000 |
| Whitchurch .. .. | 175,000 |
| Washington, U.S.A. | 2,000,000 |
| Wallasey .. .. .. | 750,000 |
| Weimar .. .. .. | 150,000 |
| Wurzen .. .. .. | 200,000 |
| Worcester, U.S.A. .. | 750,000 |
| Yeadon .. .. .. | 500,000 |
| Yeovil .. .. .. | 250,000 |

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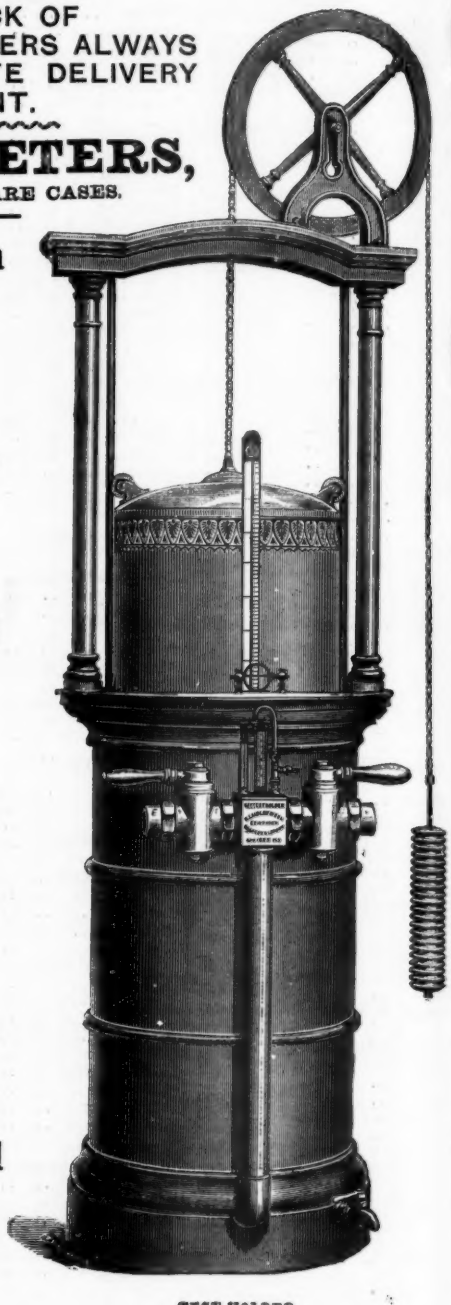

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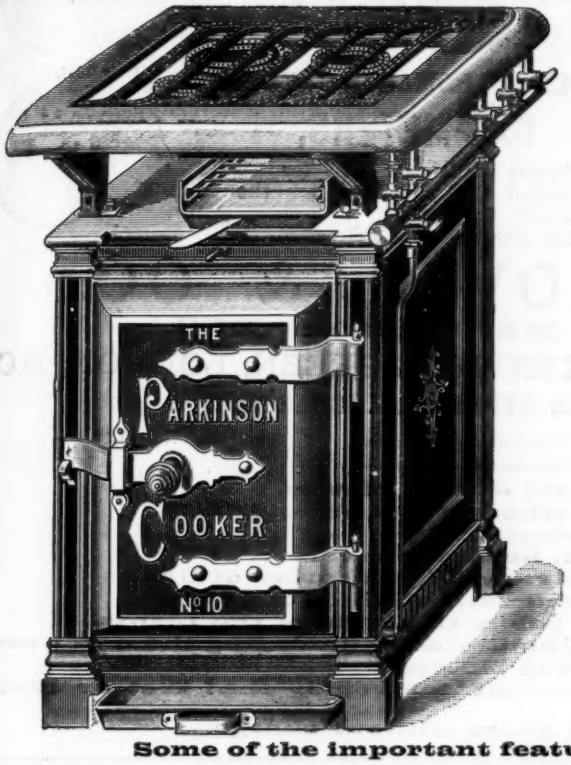

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**Case** of strong cast iron, packed with silicate to retain the heat. Most substantially made and very durable.

**Inside** lined with enamelled, patent steel plates, which enable the oven to be always kept clean.

**Fire-Brick** at top, which throws down great heat, and equalizes the temperature of the oven. For cooking Pastry, &c., the heat is perfect.

**The Oven** is splendidly ventilated, and provided with an efficient damper, which allows the heat to be retained long after the gas is turned off.

**Space over Oven** is large and free—no impediments to plates and dishes, &c.

**New Double Grill,** providing **two large square surfaces of great heat,** either of which will cook chops and steaks, &c., or toast bread to perfection. The Grill Burners can be used simultaneously for boiling **without any adaption or alteration.**

**Door of Oven** shuts immediately if slammed.

"The Cookers have already been adopted by The Gaslight and Coke Company, as well as by many other prominent Companies. Those who have tried the Stoves speak well of their efficiency and economical working; and it may be added that samples which we have seen show that Messrs. Parkinson and Co. are determined to maintain, in this class of goods, the reputation they enjoy for good workmanship and durability."—JOURNAL OF GAS LIGHTING, *May* 19, 1891.

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[See also Advt., p. 1230.

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**2nd—Are suitable for all climates, whether hot or cold.**
**3rd—Incur no loss of Gas by Evaporation.**
**4th—Cannot become fixed by Frost, however severe.**
**5th—Are the most accurate and unvarying measurers of Gas.**
**6th—Prevent jumping or unexpected extinction of the Lights.**
**7th—May be fixed either above or below the level of the Lights.**
**8th—Cannot be tampered with without visibly damaging the outer case.**
**9th—Will last much longer than Wet Meters.**
**10th—Will not cost more than one-half for repair that Wet or Water Meters do.**

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[See also Advt., p. 1229

## CONTENTS.


EDITORIAL NOTES:—

GAS, LIGHTING, &c.— PAGE

The Local National Debt . . . 1231
Work for the Labour Commission . . . 1232
Census-Taking Extraordinary . . . 1232
Mr. James Beal . . . 1233

WATER AND SANITARY AFFAIRS—

The Progress of the Metropolitan Water Inquiry . . . 1233
The Purchase of the Metropolitan Water Companies' Undertakings . . . 1233
Meetings of Metropolitan Water Companies . . . 1234

THE INCORPORATED GAS INSTITUTE:—

PROCEEDINGS AT THE TWENTY-EIGHTH ANNUAL GENERAL MEETING—

Papers and Discussions—
On the Effects of Specific Hydrocarbons on the Lighting Value of Combustible Gas. By Professor W. Foster . . . 1234
On the Effects of Wind Pressure on Retort-House Roofs and Gasholders. By A. T. Walmisley, M. Inst. C.E. . . . 1239
On Some Bye-Products. By W. R. Chester . . . 1245

ESSAYS, COMMENTARIES, AND REVIEWS:—

Gas and Water Companies in the Stock Market . . . 1250
Electric Lighting Memoranda . . . 1250
Mr. A. E. Fletcher on House-Heating . . . 1251
Henry Cockey . . . 1252

NOTES:—

Coal Discharging Machinery . . . 1252
Mr. F. Siemens's New Regenerator Furnace . . . 1252
The Hot Testing of Cement . . . 1252
Briquette Fuels . . . 1252

COMMUNICATED ARTICLE:—

The Use of Air in Purifying Gas. By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S. . . . 1253

TECHNICAL RECORD:—

Western (U.S.A.) Gas Association—Annual Meeting at Louisville . . . 1254

REGISTER OF PATENTS:—

Manufacture of Ammonia—Baudouin H., and Escarpit, P. F. . . . 1255
Guiding and Continuing Gasholders—Pease, E. L. . . . 1255
Charging and Drawing Gas-Retorts—D'Iszoro, L. S. . . . 1256
Patent Notices . . . 1256

CORRESPONDENCE:—

Mr. Grafton on the Standard of Light . . . 1257
Re-Burning Spent Lime . . . 1257
Mr. Edward's Gas Institute Paper . . . 1257
The Effective Duty of Gas in Ventilation . . . 1257
The Taxing of Sulphate of Ammonia Plant . . . 1257
Ammoniacal Liquor Meter . . . 1257
Mr. Price's Arrangement of Hydraulic Main . . . 1257

PARLIAMENTARY INTELLIGENCE:—

House of Lords—Progress of Bills . . . 1258
House of Commons—Progress of Bills . . . 1258
House of Lords Committee—Rhyl Gas Bill . . . 1258
House of Commons Committee—The Metropolitan Water Supply Inquiry . . . 1259

MISCELLANEOUS:—

Widnes Local Board Gas and Water Supply—Loss on the Gas-Works; The Value of the Dinsmore Process . . . 1262
Batley Corporation Gas Supply—Reduction in Price . . . 1262
Dundee Gas Commission—Annual Accounts . . . 1263
Meeting of the Belgrano (Buenos Ayres) Gas Company, Limited . . . 1263
Meeting of the Chelsea Water-Works Company . . . 1264
Meeting of the Seville Water-Works Company, Limited . . . 1264
Notes from Scotland . . . 1265
Current Sales of Gas Products . . . 1266
The Lancashire Gas Coal Trade . . . 1266
Gas and Water Companies' Stock and Share List . . . 1267

PARAGRAPHS.—Mr. W. Whatmough, 1233—Sir George Barclay Bruce, 1233—Coal in India, 1234—Incorporated Association of Municipal and County Engineers, 1234—Fire-Brick Manufacture in Russia, 1249—The Action of Oils on Metals, 1249—Municipal and County Engineers' Association, 1249—Society of Arts, 1249—The Estate of the Late Mr. Stephenson Clarke, 1250—Coal in Kent, 1252—New Joint Stock Companies, 1259—Rickmansworth and Uxbridge Valley Water Company, 1259—The Threatened Litigation over the Stainland Water Scheme, 1262—Large Water Scheme in California, 1262—Sales of Shares, 1262—East Surrey Water Company, 1262—Forged Debentures of a Gas Company, 1263—The Oil Lighting at Bromley to be Discontinued, 1263—Messrs. H. Balfour and Co., 1264—The Vyrnwy Water-Works, 1264—Northern Coal Trade, 1266—Gas Cookery Lectures at Warrington, 1266—The Quality of the Commercial Company's Gas, 1266—The Public Lighting of Kingswood, 1266—Abandonment of Electric Lighting at Barnet, 1266—Gas Exhibition at Landport, 1267—Gas Exhibition at Matlock Bridge, 1267—Burslem Corporation Gas Accounts, 1267—The Stockton Corporation and the Gas Workers, 1267.



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THE

# JOURNAL OF GAS LIGHTING,

## WATER SUPPLY, & SANITARY IMPROVEMENT.

*TUESDAY, JUNE 23, 1891.*


### The Local National Debt.

ALLUSION was made in the JOURNAL last week to a recent communication of a correspondent to *The Times* on the growth of local indebtedness, in which the acquisition of gas and water works by Local Authorities was advocated; and the statement was advanced that since a very great proportion of the money owed by British Municipalities is represented by productive works, there is no ground for alarm in connection with the rapid modern increase of this indebtedness. The absence of anything like instructive criticism of the manner in which many Municipalities owning gas-works understand their responsibilities to ratepayers and gas consumers, which was a glaring defect of the article in question, was corrected almost immediately by Mr. H. D. Ellis, the Secretary of the Commercial Gas Company, who pointed out the fact that gas consumers are, on the whole, better served by Gas Companies than by Committees of Corporations. We are not at present disposed to argue on this topic at any length, as it would be no novelty to our readers to be told the nature of our opinions on this subject. We refer to the article in *The Times* mainly for the purpose of drawing attention to the curious habit of thought respecting the principles and actions of Local Authorities into which some otherwise sensible people (of whom the author is a good representative) appear to have fallen. These worthy persons assume, as a matter of course, that whatever a Municipality does must be right. Does a Municipal Corporation owe money?—Never mind; there is nothing to be frightened at. Has it no debt?—Then it is a very ably managed Corporation. Does a Corporation supply gas?—Then take what it sells under this name, pay what is demanded for the supply, and be thankful. Are the gas profits applied in aid of the rates?—How public-spirited! Is gas sold at cost price?—What a splendid privilege to be a gas consumer in the district!

Now, we are bold enough to say that this sort of thing palls upon one after awhile. Great is democracy, and mighty the man with the casting vote; but we are of those who absolutely decline to accept the modern dogma of the infallibility of a Local Authority. This attitude of ours may be an old-fashioned one, and may appear ridiculous in an era when the resolutions of a mass meeting are rated higher than the law and the prophets; but we keep to it. There is no divinity about the actions of a Town Council or a Local Board; and when these bodie are seen by the calm eye of the statistician to be running into debt faster and faster every year, we hold that it is incumbent upon prudent ratepayers to ask themselves (and each other) whether all this capital expenditure is represented by proper assets. The late Earl of Iddesleigh raised a storm throughout the country by his proposal to shorten the time required for the repayment of Corporation loans to thirty years or so. But it is at least a question whether these loans are not, as a general rule, spread over too lengthened periods. The subject is not one that calls for dogmatism on either side. Some there may be who hold with Ruskin that all modern Municipal development is infect with the taint of usury. But, as in most other controversies, the truth of this matter may probably be found between the extremes. Because we hold that Municipalities are not always justified in what they do, even with the approval of the majority of their members and supporters, and insist upon the necessity of subjecting the policy of Municipalities, Companies, Corporations, and all other social bodies, to the same standard of criticism that is with common consent applied to the actions and character of individuals, it does not follow that we suspect them of a predisposition to wrong-doing. On the contrary, it is to be hoped and believed that our Municipalities constantly aim at what is right in principle and beneficial in operation.

At the same time, when one is informed that the gross indebtedness of the Local Authorities of England and Wales is already nearly 200 millions sterling, and has increased at the rate of 42·7 per cent. during the last ten years, it is pardonable to express the hope that those who are responsible for incurring all this obligation, know what they are about, and are not blinded to the truth by the facility with which they have been accommodated with the money of which they believed themselves to be in need. All must be paid; and if within the lifetime of the present generation, so much the better. Every age should pay for itself, and leave for its successor responsibility only for what has been provided for its needs. If Birmingham, for example, sets Mr. Mansergh to work to make the water supply of the district safe for the next fifty years, then the cost may reasonably be spread over a commensurate period. On the other hand, if Rhyl wants to buy gas-works for the supply of the present and the

immediate future, there is no reason why a distant posterity should be saddled with the expenses. The only safe general principle that can be discerned in these somewhat misty disquisitions concerning local indebtedness is that whatever burdens are undertaken to satisfy the requirements of this age of cheap coal, railways, gas lighting, &c., should be cleared off during the existence of the same conditions. Our coal capital is being eaten up; sooner or later it will be all gone. That day may appear distant to us; but when it is remembered that the Age of Coal has hardly lasted a century, that many centuries cannot pass before it will have given place to an age of different conditions, and that when our coal is all burnt we hope and believe that the nation will yet endure into an unimaginable futurity, it behoves our public men to be careful how they deal with the local national debt.

### Work for the Labour Commission.

THE Labour Commission has begun to take evidence; and has not begun well. This is the impression that most unprejudiced people would form after reading the newspaper reports of the opening days' proceedings of the Committee devoted to miscellaneous industries. The Press, as represented by newspaper reporters of varying degrees of intelligence, acting upon the instructions of editors who glory in their partisanship, has already presented the transactions of the Committee to the public eye in the same way as the doings at a noisy Vestry meeting would be chronicled—that is, with picturesque exaggeration of the "incidents" and "scenes." The Dockers had the first innings, and brought up witness after witness who made *ex parte* speeches, dealt in generalities unsusceptible of proof, and generally brought into the proceedings the air of the mass meeting. Time was thus taken up by listening to twaddle about the "labourers' position" that might be overheard any night in a Canning Town public-house, which the reporters for the evening papers watched lynx-eyed for a noticeable "bit" that could be served up hot on a poster. If this sort of thing goes on, the value of the Commission will be indicated by a minus quantity. What is wanted of such an inquiry is very plainly stated in a recent issue of the *St. James's Gazette*, under the head, "Work for the Labour "Commission," which begins by examining the attitude of the London Trades Council to the Commission, and goes on to discuss the rights of the claim put forward on behalf of this body to speak on behalf of London labour. From this the writer proceeds to criticize the methods and effects of the "New Unionism;" establishing a very uncomfortable parallel between these and the tricks of Broadhead's saw-grinders. It is proposed to issue, for the purpose of the present inquiry, a list of questions to Trade Union officials, who will doubtless, our contemporary observes, be eager to "strut their little hour upon a stage "on which the eyes of their paymasters are fixed." But, it is reasonably suggested, evidence must be obtained from "the multitudes of men who will not enter the ranks of "the new Unions, or who have enrolled themselves under "some kind of coercion;" and to these witnesses must be added some of "the thousands who have been compelled "by threats to join Unions which have done nothing for "them but to order them, again under menaces, to leave "employment which once left has been lost for ever." Ex-gas stokers of the South Metropolitan, Salford, and other works; ex-dock labourers at Hay's Wharf, Liverpool, and Southampton; ex-railway workers from the Scottish lines —"abandoned by the Unions that got them into their "difficulties, they are now scattered all over the country, "many probably tramping from town to town in search "of work, with their wives and families, and in no con-"dition, like the fat official or the advertising philan-"thropist, to volunteer their evidence." The tale that such men could tell must be told, if the Commission is to be instructed in the wrongs as well as the rights of Trade Union working.

American experience is very instructive upon this head. We have mentioned once or twice the strike of the coke workers in the Connellsville region, which began over a question of wages, soon developed into rioting and bloodshed, and has now collapsed, an unquestionable failure. The State of Pennsylvania lost little time, in this instance, in demonstrating to the strikers that "the game of law "and order" was not "up," even in the back settlements of this sovereign Commonwealth. A few local representatives of the Wilson and Thorne type, organizing what they were pleased to call "moral demonstra-"tions" against the employers and their new hands who had been engaged in place of the strikers, were shot by way of encouragement to the others; and thereafter the strike languished. After four months' loss of wages, to say nothing of the other penalties for failure, those of the strikers who have not emigrated have had to go in again on the terms which they rejected so arrogantly. An American strike is no joke. Neither side is disposed to handle the other gingerly; and the Yankee equivalent for the month or six weeks' imprisonment which a convicted rioter or intimidator gets from a Magistrate here is represented in the States by a shot from a Deputy-Sheriff's revolver.

The *St. James's Gazette* truly remarks that "no upright "employer and no political party in this country can have "the slightest objection to any combination among work-"men which is led by honest men, and keeps to legitimate "methods." The difficulty is, however, that these combinations have an almost incurable tendency to intermeddle with matters that do not rightly concern them. In very many of the instances where employers have set their faces against a Union, it would be found on inquiry that this course of action had been forced upon them by the interference of Union officials with questions of management that the employer, who pays the wages, thinks he ought to deal with himself. Frequently a factory is slyly converted into a Union shop without the employer being consulted on the matter or made acquainted with the change, which he first discovers by being informed that some regulation or order of his cannot be obeyed because it is against the Union rules. The fact that there may be no novelty or hardship in the employer's requirements is not allowed to affect the issue; and the more fussy and bumptious the "branch" officials of the Union, the more numerous and irritating are these interferences of the employed with the functions of the employer, until the end comes in a lock-out or a strike, when in the vast majority of cases the master wins.

### Census-Taking Extraordinary.

THE United Kingdom has just passed through the ordeal of census-taking; and many worthy householders who were called upon to fill up the papers, regarded the task as anything but a pleasant or a profitable one. Some people, as is well known, looked upon the questions tabulated in the well-remembered blue sheets as unwarrantably inquisitive; and professional humorists made great fun out of the imaginary dilemmas of their fellow-subjects, when required to furnish personal particulars under more or less awkward conditions. Census-taking in the United Kingdom is, however, a mere formality, compared with what passes under the same name in the United States. There, the census is a great national amusement, upon which the Federal Government spends an enormous amount of money. A host of ingenious officials is employed during the intervals between the actual taking of the United States census, in devising forms of inquiry (to be used next time), which shall record more fully than ever the facts of the national existence; and hopes are entertained of a bright future when every citizen shall find employment in collecting vital, industrial, or some kind of census statistics. For an American census is all-embracing, as may be seen from the special schedule relating to manufactured gas, a copy of which has been sent to us by Mr. George W. Graeff, jun., of Philadelphia, the Special Agent appointed to collect the statistics relating to this industry. The period to be covered by the return in question is the year beginning July 1, 1889, and ending June 30, 1890. The schedule is a pamphlet of twenty pages, containing queries divided under fifty heads. Averaging the number of questions proposed at six for every division, we have therefore 300 pointed inquiries relating to the condition of their business which every Gas Company in the United States must answer under Government direction. One is curious to know how the Companies like it. It is at least conceivable that some gas managers would prefer to pay forfeit rather than fill in all these fussy returns. The old familiar "circular of "inquiry" nuisance is nothing to this product of Western civilization. The traditional Yankee is an inveterate asker of questions; and we can only suppose that the gas census paper must be taken as a piece of sublimated

Yankeeism. At any rate, we entertain a strong suspicion that if our Board of Trade were to expand their returns relating to statutory gas undertakings in any such fashion, the responsible officials would be ridiculed in Parliament, and the papers would find repose in the waste-paper baskets of the managers to whom they might be addressed. What useful purpose is served by such an inquisition as the people of the States are visited with under the name of the census, is a problem that we cannot pretend to answer.

### Mr. James Beal.

The death of Mr. James Beal, well known for many years past as an advocate of reform in the local government of London, furnishes *The Times* with a subject for an article which suggests many reflections. Mr. Beal was a representative, in his way, of that public virtue which we love to believe is a striking characteristic of the English people. He maintained himself by a respectable, if not particularly lofty calling; and he spent his spare time, energy, and cash in the endeavour to create a Municipality that should correspond as perfectly as might be to that wonderful example of the concrete-abstract called London. Everybody knows what London is—the richest city, the largest town, the most ancient and the most modern of all the populous places of England. As *The Times* puts it, "Take "it for all in all, London is a community, which, in all "the elements of advanced civilization, has no parallel in "the history of the world." When, therefore, Mr. Beal and his associate, Mr. Firth, drew attention to the remarkable fact that, in all that appertains to local government and local life, London was a name without meaning—that, in a very obvious sense, London did not exist as a recognizable entity—they were listened to as are men who have succeeded in detecting a flaw in the British Constitution. After much agitation and many years of effort in the cause, Mr. Beal and Mr. Firth lived to see a sort of municipal organization created for the London which, at the time when they began their crusade, was administratively only a group of unconnected Vestries. They did not live long to enjoy this realization of their dream. Mr. Firth, after having been in a measure rewarded by office and salary for his labours, died before he had any opportunity for demonstrating the efficiency of the big administrative machine which he had helped to create; and now Mr. Beal has gone, without receiving even so much recognition and gratification as his younger colleague had in his briefer day. And their example supplies yet another occasion for a homily on the text: "Who of us, "having his desire, is satisfied therewith?" The father, as he might be called, of London Municipal Reform became only a very useful, but not a very eminent member of the London County Council; and what is the London County Council that a man should regard membership of it as a fitting crown to a life of work in the public interest? Try as one may to take an interest in the County Council and its work, it is altogether impossible to regard it as adequately representing London. Even in respect of purely business affairs, it must have disappointed Mr. Beal. In his estimation, the satisfactory Municipality for London should be capable of supplying the community with water and gas, at least, besides doing many other things infinitely better than a provincial Corporation can perform similar public duties. Mr. Beal lived to perceive that the County Council cannot deal with the water supply alone—to say nothing of the gas. He gave up all hope of seeing the gas undertakings of London in the hands of the new governing body; and this must have been a sharp disappointment to him. He said in his lifetime many bitter things about the gas supply of London; but we bore him no resentment on this score. He was a mild kind of agitator, after all, with too much good sense to fall into the Communism which goes down now-a-days as the staple of "popular" politics; and the London County Council will do well enough if its rank and file are kept up to his standard.

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**Mr. W. Whatmough,** the Manager of the Heywood Corporation Gas-Works, has recently had his salary increased by £30 per annum.

**Sir George Barclay Bruce,** Past-President of the Institution of Civil Engineers, has been elected an Honorary Member of the Society of Engineers, in the place of the Right Hon. Earl Granville, K.G., deceased.

## WATER AND SANITARY AFFAIRS.

Sir Matthew White Ridley's Committee sat again for three days last week; and the third day saw the close of the case for the London County Council, in relation to the Bill of the Vestries. To-day Mr. Moulton is to sum up the case for the Council, though the arrangement seems somewhat peculiar. The Companies have not yet been heard; and possibly there are a few more witnesses to come from the outer areas. The proceedings of the Committee were rather shrewdly criticized by the Governor of the Chelsea Company last week, at the half-yearly meeting of that body. Sir W. H. Wyatt, on that occasion, regretted to say he could not tell the shareholders much with regard to the inquiry before Parliament; the Committee having "so "changed and shifted about from one point to another, "that it was impossible for anyone to tell what they would "or would not do next." Amid the tangle in which the question is involved, we may perhaps make out two or three clear lines. One is that the Metropolitan Water Supply must become the possession of a public authority. This line was laid down long ago by the Select Committee on Sir Richard Cross's Bill; Sir William Harcourt being then Chairman. The next point we now learn is, that the present Committee are "inclined" to accept the proposals for a Statutory Committee, to be formed out of the County Council and the Corporation. We are afraid we cannot get much farther than this, except that persons who are not members of the County Council may be elected on this Committee. It has been decided that the Select Committee will not go into detail as to the quantity and quality of the supply; but Sir M. W. Ridley says it is admitted that there ought to be an inquiry into these points; "and," he added, "the only question was whether "that should come before or after the purchase of the "undertakings of the Companies." Mr. Freeman at once laid before the Select Committee "the decided view" of the County Council, that, before any compulsion to purchase was put upon them, full power of inquiry as to the quantity and quality of the water should be conferred. With respect to the manner in which the Companies are to be dealt with, the prospect continues very obscure. The County Council seem disposed to put the question of purchase a long way off. The fact is that the Council are by no means in a state of preparation for facing the problem. Of this unreadiness Mr. Charles Harrison, Chairman of the Parliamentary Committee of that body, gave very distinct proof in his evidence before Sir M. W. Ridley's Committee last week. Asked as to what should be done with the authorities of the outer areas, he expressed his willingness that they should be in the fullest way "consulted." But he went on to say that the Council and the Corporation "were not in a position, "without further inquiry, to deal with the subject." On the financial part of the affair, including the terms of purchase, Mr. Harrison said that the Council were not prepared to deal with the question at all, until it was settled by Parliament whether they would extend the time for the payment of the capital sum "to 100 years or for ever." It appears that by the existing law the loan must be paid back within sixty years. On the whole, the margin of difference is a wide one.

The idea of a Royal Commission is revived in the evidence of Mr. Charles Harrison, and there is a strong and persistent demand from the County Council for an "inquiry" on the water question. Mr. Harrison thinks nothing so good for this purpose as a Royal Commission, except that "a statutory authority" should at the same time inquire into some part of the subject, and have power to promote a Bill in Parliament. Altogether there seems to be a wonderful deal of power wanted to set the machinery in motion. Mr. Haggis, the Deputy-Chairman of the County Council, considered that the Statutory Committee should be the authority "to settle the basis of "purchase." On this point it is well that the ratepayers should look a little ahead. Mr. Harrison calculates that the County Council will have to borrow £20,000,000 in order to buy up the Water Companies; and that the repayment of this sum, if spread over a period of sixty years, will involve a charge of £333,000 per annum. In the main, this must be an extra burden thrown upon the public; and Mr. Harrison is so conscious of the fact, that he is dismayed at the thought of throwing the capital

purchase-money entirely upon the occupiers. "Some "scheme," he says, "must be devised to remedy that state "of things." It is clear that somebody will have to pay; and we fear that the total cost has hardly yet been reckoned. In 1889 the rates and taxes paid by the Metropolitan Water Companies, exclusive of income-tax, amounted to £155,763. Under the quinquennial valuation this amount will be increased; and if the Water Companies are bought up, what becomes of it? The burden clearly falls, in one shape or another, either on the water consumer or the ratepayer. If we add the two amounts together, the redemption of capital and the equivalent for rates and taxes, we get a total of at least £500,000 as an additional load on the finances of the Metropolis. This is equal to at least one-fourth the gross water-rental, and considerably more than one-fourth the net water-rates. It is actually more than one-half the net profit of the water undertakings. Mr. Harrison also says: "If Parliament "saw fit to constitute them the authority, the Council "would at once bring up a proper financial scheme." As much light as possible on this "proper" scheme may be desirable beforehand; and in this direction a careful "inquiry," by Royal Commission or otherwise, might not be amiss. In the meantime, we should like to know what it is that enamours the Corporation so strongly in favour of their one-eighth representation on the Statutory Committee. The members of the Court of Common Council have conducted the Lord Mayor from the lobby to his carriage amid "vociferous cheers," in recognition of his devotedness to the compact, and of his resolution in facing the strictures of Mr. Morton, who declared that the County Purposes Committee had "gone down on their "hands and knees to the County Council."

Three of the London Water Companies have recently held their half-yearly meetings. In two instances there was a reduced dividend—the Southwark and Vauxhall taking 6½ instead of 7 per cent.; and the Grand Junction, 8 instead of 9 per cent. The decreased dividend may to a large extent be accounted for by the increased charge for maintenance due to the prolonged frost of the past winter. The heavy cost of the present parliamentary inquiry has also to be met, and requires a careful forecast. The price of coals is another element. Rates and taxes continue to rise, and the Grand Junction Company have lost £1000 by a defalcation on the part of one of their collectors. Abnormal circumstances thus operated against the Companies, while there is nothing to indicate any real decline in their prosperity. As it is, the Southwark Company could have paid 7 per cent. had they seen fit; and apparently the Grand Junction might have gone higher than 8 had the Directors thought it well to do so. The third meeting was that of the Chelsea Company, at which a happier state of things was declared; the full dividend of 10 per cent. being maintained, though the expenses connected with the frost had taken away £2000. A portion of Sir W. H. Wyatt's statement is dealt with in our previous remarks.

**Coal in India.**—The production of coal in India during the past year shows a large increase over the output of 1889. This increase is general throughout the peninsula, with the exception of the Central Provinces. The production for the year was upwards of 2,000,000 tons, or an increase of 11½ per cent. as compared with 1889. The most remarkable increase was at the Singareni coal-field, in the Deccan, where the output rose from 59,000 tons in the earlier year to 125,000 tons in the later. It is considered by competent authorities that the Indian output could be doubled if the rates of carriage by rail and steamer were reduced, and that, too, without taking into account the possibilities there would be for cheaper fuel to come into general use for domestic purposes.

**Incorporated Association of Municipal and County Engineers.**—A meeting of the members of this Association in the Eastern Counties district was held at the Guildhall, Norwich, on Saturday, the 13th inst., under the presidency of Mr. O. C. Robson, of Willesden. One of the papers to have been submitted on the occasion was "On Gas-Burners and Gas-Burning," by Mr. E. C. Sayer, of Ipswich; but this gentleman was unable to be present, owing to his suffering from an attack of influenza. Mr. H. K. G. Bamber, of Dovercourt, read a paper on "Portland Cement—Specifications and Mode of Testing," in which he suggested that, in place of the present tests, engineers should insist on the cement being of a fixed chemical combination. This, in conjunction with the specific gravity, would, he thought, ensure an article the strength and safety of which could be relied upon. At the close of the business, the members visited Norwich Castle, and the various public works of the city.

# THE INCORPORATED GAS INSTITUTE.

## PROCEEDINGS AT THE TWENTY-EIGHTH ANNUAL GENERAL MEETING,

HELD AT THE

COUNTY HALL, CARLISLE, JUNE 9, 10, & 11, 1891.

Mr. J. HEPWORTH, M. Inst. C.E., President.

In our report of the technical portion of the business at the above meeting, given in the JOURNAL last week, we broke off at the close of the paper contributed by Professor Vivian B. Lewes, F.I.C., F.C.S., "On the Enrichment of Coal Gas by the Various Processes other than Cannel," with which the proceedings on the first day closed. The next morning,

The PRESIDENT said he thought it would be for the general convenience if, before discussing Professor Lewes's paper, he asked Professor Foster to read his.

Professor W. FOSTER (London) then read the following paper:—

### ON THE EFFECTS OF SPECIFIC HYDROCARBONS ON THE LIGHTING VALUE OF COMBUSTIBLE GAS.

Whatever public knowledge there may be with reference to the lighting value of definite hydrocarbons, I believe it is largely, if not entirely, due to the labours of Dr. Percy Frankland. He has made experiments with three well-known hydrocarbons, each of which is gaseous at ordinary temperatures, can be obtained in a fairly pure state without much difficulty in a well-equipped laboratory, and is present in greater or less amount as one of the ordinary constituents of coal gas. The three substances examined were ethylene ($C_2H_4$), ethane ($C_2H_6$), and propane ($C_3H_8$).* At about the same date, Mr. Lewis T. Wright made a few experiments with marsh gas ($CH_4$).† I am not aware of any further experiments on the lighting value of these four, or any other, hydrocarbons. The determination of the lighting value of solid and liquid hydrocarbons has often been attempted; but as the methods employed are always indirect, I will refer to these subsequently.

A few weeks ago I obtained specimens of a fifth known hydrocarbon, named butylene ($C_4H_8$), containing 96 per cent. by volume of the pure substance. I hoped to put before the meeting some figures referring to the lighting value of this interesting substance, which could be taken without qualification. Unfortunately, I found my specimens, when prepared in bulk (between 4 and 5 cubic feet), contained 84·80 per cent. of butylene; of the paraffins, ethane and propane, 4·79 per cent.; and of air, 10·41 per cent. However, this mixture has been carefully examined photometrically and chemically. The following data were obtained; the gas being consumed in an improved Sugg's Argand burner, having a 7-inch by 1¾-inch chimney. It was not possible to burn this gas with any flat-flame burner in my possession at the time; and as the gas is not likely to be put on the market, most probably flat-flame burners are not made as articles of trade for the consumption of such extremely rich gas.

Above 0° C., butylene is a gas. It is about twice as heavy as air, and burns with an intensely smoky flame. It is a member of the olefine series—a class of unsaturated hydrocarbons having ethylene ($C_2H_4$) as the lowest known member of the series. For some time past I have desired opportunities for ascertaining the lighting values of members of the olefine series; because I feel certain that such information will not only be useful in connection with the practice of carburetting, but will most likely assist us in considering some of the enigmas connected with the lighting values of gaseous mixtures. The following data have been obtained with this 84·8 per cent. specimen of butylene:—

| Date. | Gas Used in C. Ft. per Hour. | Lighting Power in Sperm Candles. | Lighting Power per 5 C. Ft. of Gas. | Lighting Power per 5 C. Ft. of Pure Butylene. |
|---|---|---|---|---|
| June 4— Temp., 65·5° F.; bar., 753 mm. | 0·6250 | 12·2 | 97·5 | — |
| June 6— Temp., 62·5° F.; bar., 757 mm. | 0·6250 | 13·3 | 106·0 | 123 |
| | 0·6125 | 12·6 | 103·0 | |

The only member of the olefine series previously

* See *Journal of the Chemical Society*, January, 1884, and April, 1885; also JOURNAL, Vol. XLIII., p. 742, and Vol. XLIV., p. 17.

† See *Journal of the Chemical Society*, April, 1885; also JOURNAL, Vol. XLV., p. 435.

examined is ethylene. Dr. Percy Frankland gives 68·5 candles as the lighting value of this gas per 5 cubic feet per hour when consumed in a "London" Argand. Therefore the figures for butylene, as they stand, would seem to indicate that the lighting values of the olefines bear some simple relation to the number of atoms of carbon in the molecule; butylene having double the number of carbon atoms, and almost twice the lighting value. This is in agreement with Frankland's observations of the two corresponding paraffins, ethane and propane. He found that 5 cubic feet of ethane ($C_2H_6$) gave a light of 35 candles; while 5 cubic feet of the higher paraffin, propane ($C_3H_8$), gave a light of 54 candles—an increase in the number of atoms in the molecule by one-half being attended with an increase in lighting value of one-half.

The subject is one which needs very careful treatment; for if Frankland's observations with the paraffins—and I have practically confirmed them with reference to the two olefines, ethylene and butylene—are to hold, how is it that marsh gas ($CH_4$), the first of the paraffins, has not a lighting value of one-half that of ethane—namely, 17·5 candles? Mr. Lewis Wright gives the lighting value of marsh gas as 5 candles per 5 cubic feet; and everyone acquainted with its lighting value knows how insignificant it is. Yet marsh gas has a value in luminous combustible gases which is material.

The following table shows the relationship of the five hydrocarbons referred to:—

*Paraffins.*

| | | |
|---|---|---|
| Marsh gas ($CH_4$) | 5·0 candles per 5 c.f. per hour | (L. Wright). |
| Ethane ($C_2H_6$) | 35·0 " " " | (P. Frankland). |
| Propane ($C_3H_8$) | 54·0 " " " | " |

*Olefines.*

| | | |
|---|---|---|
| Ethylene ($C_2H_4$) | 65·5 candles per 5 c.f. per hour | (P. Frankland). |
| Butylene ($C_4H_8$) | 123·0 " " " | (Foster). |

*Other Hydrocarbons.*

| | |
|---|---|
| Naphthalene ($C_{10}H_8$) | 933·0 (?) candles per 5 cubic feet of vapour. |
| Gasoline . . | 163·5 " " " " |

The determination of the lighting values of such substances as those cited, by simply burning them in air in specified apparatus at given rates, yields results which are not open to any very serious criticism. I now come to the consideration of two bodies, one of which is a solid with a high boiling-point, and the other a commercial liquid with a low boiling-point. In each case we require some gas, combustible or otherwise, for conveying the hydrocarbon to the burner; and the result so obtained must be modified by the nature of the conveying medium. Dr. Frankland made a series of observations* of the lighting value of ethylene when mixed separately, in varying proportions, with each of the three gases—marsh gas, hydrogen, and carbonic oxide. The highest values were obtained with marsh gas, and the lowest with carbonic oxide. In other words, the determination of the lighting value of ethylene, as an enricher, is modified by the nature of the gas enriched, although it may be a combustible and non-luminous one. In the calculations I have made respecting the value of naphthalene and gasoline when burned in coal gas, I have assumed that the lighting values of these bodies are in simple proportion to the amount present. This is not strictly true; however, some information upon the point will appear in the concluding portion of this paper.

Naphthalene ($C_{10}H_8$) being a solid with a high boiling-point, the determination of its lighting value, when consumed alone, is rendered an almost impossible task. The difficulty is still further increased by its extreme richness in carbon; the percentage amount of this element being 93·75. All our knowledge of the lighting value of this hydrocarbon is derived from observations of the lighting value of a combustible gas containing an observed weight of the vapour of naphthalene. The only quantitative experiments in which I have been connected are those which were made jointly with Mr. Dibdin for the Committee of The Gas Institute.† We found that 5 lbs. of naphthalene were required to double the lighting value of the gas used—viz., so-called 16-candle gas. In arriving at this conclusion, we assumed that the gas we were using at the time would give a light of 14 candles, or 2·8 candles per cubic foot, when consumed in a flat-flame burner. Such a value had actually been obtained with some special flat-flame burners; but they were not used at the time by the Albo-Carbon Company. If, therefore, 5 lbs. of naphthalene doubles the lighting value of 1000 cubic feet of gas, giving, by our assumption, 2·8 candles per cubic foot, this quantity of naphthalene has a value of 2800 candles. What, then, is the volume of 5 lbs. of naphthalene when in the form of vapour? Air being the standard substance, the density of naphthalene is 4·4. One cubic foot of air at 62° Fahr. weighs (say) 0·076 lb. One cubic foot of naphthalene vapour, corrected for the same temperature, weighs $4·4 \times 0·076 = 0·3344$ lb. Therefore the 5 lbs. of naphthalene in the form of vapour occupy a volume of 15 cubic feet; and the lighting value of each cubic foot in the experiment becomes $2800 \div 15 = 186$ candles, or 930 candles per 5 cubic feet. Expressed in another way, we may say that 1000 cubic feet of gas, giving a light of 14 candles per 5 cubic feet in a good flat-flame burner, is increased in volume by 5 lbs. of naphthalene to 1015 cubic feet, the lighting value of such carburetted gas being 28 candles per 5 cubic feet. (In the actual experiment no observation of the increase in volume is possible.) Expressing the same facts in the usual way, we see that 1½ per cent. by volume of naphthalene vapour suffices to double the illuminating power of our 16-candle coal gas, and that therefore the actual volume of such vapour of this hydrocarbon in our common gas must be excessively small, because of the known presence of several other light-giving hydrocarbons. All these hydrocarbons, naphthalene included, do not amount to much more than 5 per cent. by volume of ordinary 16-candle gas. There is, therefore, no process for the estimation of naphthalene in coal gas likely to be based on the measurement of the volume which it occupies. However, it has the property of giving ten times its volume of carbonic acid on combustion in oxygen; and this might be utilized in a qualified way.

The experiments which I have made with commercial gasoline—now extensively used in London for carburetting combustible gas—were undertaken, in conjunction with Mr. Frank W. Clark, about two years ago. The sample used had a specific gravity of ·661, and was not one specific hydrocarbon but most probably a mixture of several, having boiling-points not widely separated. The importance of this liquid to the gas engineer at the present time for enriching purposes is well known. We found that 1000 cubic feet of coal gas drawn from the main of a London Gas Company, when charged with the vapour of 4·5 gallons of the gasoline, became 1175 cubic feet. This new volume was found to have a lighting value of 32·4 candles per 5 cubic feet, or 6·48 candles per cubic foot, when consumed in a flat-flame burner taken at random from the burners in use at the works where the experiments were conducted. The same burner, when used in the works with uncarburetted gas, gave 9·4 candles per 5 cubic feet, or 1·88 candles per cubic foot.

Therefore 100 cubic feet of the uncarburetted gas has a value of $1·88 \times 1000 = 1880$ candles, and 1175 cubic feet of the carburetted gas have a value of $6·48 \times 1175 = 7614$ candles. From the consumer's point of view, he obtains four times the light by the use of this quantity of gasoline. The actual increase in candle power is $7614 - 1880 = 5734$. If we assume the character of the liquid to be pure pentane ($C_5H_{12}$)—and this assumption can only be approximately correct—we can calculate the volume of the vapour of 4·5 gallons of gasoline. The density of the vapour of pentane is 2·5 times that of air; and therefore one cubic foot weighs $0·076 \times 2·5 = 0·19$ lb. The weight of 4·5 gallons of gasoline of specific gravity ·661 = 29·745 lbs.; and the volume therefore works out at 156 cubic feet. Taking the figures of the experiment—viz., 175 cubic feet—the average candle value for the 4·5 gallons of gasoline, in terms of a cubic foot of the vapour, is $5734 \div 175 = 32·7$ candles. In other words, 5 cubic feet of gasoline vapour have a value, according to these figures, of 163·5 sperm candles. On the assumption that a gallon of gasoline gives 40 cubic feet of vapour having a lighting value of 32·7 candles per cubic foot, we obtain $40 \times 32·7 = 1308$ candles as the value of this quantity. To raise 10,000 cubic feet of gas from 16 to 17 candles requires an addition, in candle value, of 2000 candles. The quantity of gasoline to effect this will therefore be $2000 \div 1308 = 1·53$, or a little more than 1½ gallons.

Since these experiments were made, the demand for gasoline has led Mr. Clark to look afield. He informs me that he has been led to consider the use of different

* See *Journal of the Chemical Society*, January, 1884; also JOURNAL, Vol. XLIV., p. 17.

† See "Report of Crystal Palace Electric and Gas Exhibition, 1882-83," Vol. I., pp. 54-58.

samples of carburetting liquids, and that he is now supplying in quantity a body which is not the same physically (and, most probably, is not quite the same chemically) as the sample on which I worked. Although I have had a sample submitted to me, I have not had time to examine it. One gallon of this is said to be sufficient to raise 9000 cubic feet of coal gas from 16 to 17 candles. If the price of this class of liquid can be kept at the present figure, it appears to me that its use will rapidly extend. There is no question as to its utility and convenience.

I have personally made a series of photometric observations with mixtures of London common gas, and the sample of butylene previously referred to. The gas was stored in a 5 cubic feet holder, kindly lent me for the occasion by the South Metropolitan Gas Company, and was kept some days before use, without diminution of volume, under a pressure of 1 inch of water. The chemical composition and lighting value were determined, at the end of the experiments, with the mixtures described in the following table. Being a gas nearly twice as heavy as air, a device was adopted for effecting the proper admixture of the two gases, and also for keeping the specimen from being contaminated with common gas. The mixtures were stored in a second 10-feet holder. By opening, to a suitable degree, the taps connected with the two supplies, it was found possible to regulate the quantities needed while the mixing was taking place. A water-seal prevented any possibility of back-flow.

The illuminating power of each of the various mixtures was determined by a number of burners arranged on a tap with rotating arms, an example of which is before you.* It has enabled me to test the same sample of gas quickly by means of six burners, three of which were Argands and three flat flames. By a special device I have arranged for the determination of the lighting value of a flat-flame burner in two positions—viz., one in which the plane of the flame coincides with the plane of the disc of the photometer, and the other in which the plane of the flame is vertical, and at right angles to the disc of the photometer. The two positions are technically known as the "flat side" and the "edge," and are so marked in the table. The primary object of my inquiry was to ascertain the relation between the illuminating power and the quantity of substance used for enriching a specimen of combustible gas; and, by means of a series of observations, such as I now venture to lay before the Institute, to arrive at figures which would express such relation numerically. Although I have not attained my object, the information gained is interesting, and may possibly be useful to some. The three Argands were as follows: Sugg's improved Argand, with 7-inch by 1¾-inch chimney, "London" standard Argand (Referees), with 6-inch by 2-inch chimney; an Argand of foreign manufacture. The three flat-flame burners were Sugg's table-top, No. 5, No. 4, and No. 3 respectively.

On glancing at the table of results, the chief point which strikes one is the irregularity of the rise in illuminating

| — | Sugg's Improved Argand, 7 in. × 1¾ in. Chimney. | | "London" Argand, 6 in. × 2 in. Chimney. | | Foreign Argand. | | Table-Top Burner, Flat Side to Disc. | | Table-Top Burner, Edge to Disc. | | Table-Top Burner, Mean Results of Flat and Edge. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| Ordinary gas | 17·5 | .. | 16·3 | .. | 13·5 | .. | .. | .. | .. | .. | .. | .. |
| | 16·8 | .. | 16·6 | .. | .. | .. | 15·7 | .. | 12·6 | .. | 14·1 | .. |
| With 2 per cent. of enricher. | 19·3 | 1·8 | 17·8 | 1·5 | 15·6 | 2·1 | No. 5, 18·1 | 2·4 | 15·4 | 2·8 | 16·7 | 2·6 |
| „ 4 „ „ | 21·2 | 1·9 | 19·7 | 1·9 | 18·0 | 2·4 | „ 21·1 | 3·0 | 18·3 | 2·9 | 19·7 | 3·0 |
| „ 6 „ „ | 21·9 | 0·7 | 21·5 | 1·8 | 18·5 | 0·5 | „ 24·7 | 3·6 | 20·3 | 2·0 | 22·5 | 2·8 |
| „ 8 „ „ | 23·7 | 1·8 | 23·0 | 1·5 | 18·6 | 0·1 | „ 27·2 | 2·5 | 21·2 | 0·9 | 24·2 | 1·7 |
| „ 10 „ „ | 24·6 | 0·9 | 23·5 | 0·5 | 20·6 | 2·0 | No. 3, 29·7 | 2·5 | 22·9 | 1·7 | 26·3 | 2·1 |
| „ 12 „ „ | 27·2 | 2·6 | 25·7 | 2·2 | 22·5 | 1·9 | No. 4, 37·4 | 7·7 | 29·0 | 6·1 | 33·2 | 6·9 |
| „ 16 „ „ | 36·4 | 9·2 | 27·5 | 1·8 | 23·8 | 1·3 | „ 41·2 | 3·8 | 30·0 | 1·0 | 35·6 | 2·4 |
| | | | | | | | No. 3, 38·8 | 1·4 | 31·4 | 1·4 | 35·1 | 1·9 |

(1) Candles per 5 cubic feet per hour. (2) Difference in candles for 2 per cent.

power for equal increments of the carburetting agent; each burner giving erratic figures at some point or other in the series. That the varying results are not due to insufficient admixture of the rich and poor gas is, in a sense, shown by the irregularities of a particular burner, with a given mixture, not coinciding with those of another burner. At the present time I attach more importance to the results obtained with flat-flame burners than with Argands; and a comparison of the figures will show how well the flat flames come out. But in these observations I wish it to be understood that I consider the ordinary way of testing flat flames most unfair. The figures which I now submit speak more strongly than any words I could employ. It appears to me that if flat flames were tested in two positions, and an average of the results was taken as the lighting value of the flame, we should have figures which could be compared among themselves, which would more closely agree with the values given by good Argands, and (what is far more important) would express the lighting values enjoyed by the ordinary gas user.

I do not feel justified in drawing any very hard-and-fast conclusion from these experiments, more particularly because I have promised to give the Secretary of the Institution of Civil Engineers a paper on these matters during the coming winter session, for which purpose it will be necessary to supplement my experiments with others of a kindred nature. For all ordinary purposes, it would appear that the rule, or practice, of regarding the amount of light obtainable from a carburetted coal gas as being proportional to the amount of carburetting material, is not far away from the truth; and that with suitable flat-flame burners, used in both positions indicated in the paper (the mean results being taken as the illuminating values of the mixtures), we have a fairly regular proportion maintained. One cannot fail to be impressed with the very diverse numbers attributed by the experiments to a particular sample of gas. They distinctly indicate how careful one ought to be in stating what the illuminating power of a sample of gas is, unless one at the time gives the exact circumstances under which the observations were made. Then, and only then, can a correct estimate be formed.

In this paper, the following points appear fairly distinct. That the paraffin gases have a specific illuminating value of one-half, or thereabouts, of the olefines. The paraffins and the olefines are closely related in their physical properties, such as specific gravity and boiling-point. All are found in oil and coal gases. As the paraffins and olefines are found in commercial liquids, and mainly constitute them, a mere statement of specific gravity and boiling-point does not indicate their particular value as carburetting agents. A neglect of such facts explains the great diversity of opinion which exists with reference to the use of commercial liquids; such being identified by mere specific gravity and boiling-point. The lighting values of flat flames should be given in the two directions, "flat" and "edge."

### *Discussion.*

The PRESIDENT thought the members were all very much indebted to Professor Foster for the valuable paper that he had just read. He (the President) only feared that its length would operate against its being fully discussed. When the author had himself stated candidly that he had not had time to study the real results of his own figures, he could hardly complain if those who had only just heard them, were in a still more helpless position. He hoped, however, that, if the paper were not much discussed now, it would be thoroughly studied at home by all the members, when they had it in print.

Mr. W. A. VALON (Ramsgate) said Professor Foster's paper, when carefully read, would probably be very instructive; but, hearing it for the first time, he did not feel competent to discuss it. One remarkable point which appeared to stand out prominently was that the olefines seemed to have double the illuminating value of the paraffins; and if this were established, a good many of the members would have to revise their conclusions, and perhaps unlearn something of what they had learned. In regard to Professor Lewes's paper, it was much to be regretted that this gentleman was not able to be present, to answer a

* The appliance shown by Professor Foster was described and illustrated in the JOURNAL for Jan. 27 last, p. 158.

few questions which might have been put to him, and which would have enabled the discussion to proceed more profitably than it could now do. As it was, he could only offer a few remarks upon it. The matter was simplified by the manner in which the subject had been divided—the first method dealt with being the carburetting of gas by charging it with the vapour of volatile hydrocarbons; and he understood that Professor Foster agreed generally with Professor Lewes's conclusions on this point. He (Mr. Valon) must say that, so far as his own experiments went, all such methods were more or less failures; and one fact alone was almost enough to prove this beyond dispute—viz., that those who carburetted gas in that way were always afraid to mix the hydrocarbon with the gas before it was put into the holder, but introduced it as the gas left the holder, and went out into the district. Now, it appeared to him that what took place in an aggravated form in the gasholder, must also take place, though perhaps in a somewhat mitigated degree, in the passage of the gas from the holder to the consumer. Therefore it seemed to him that, if satisfactory results were to be secured at the further end of the district, the gas must be over-carburetted at the works. How far this evil extended, he did not know; but, from all the experiments he had carried out, he had come to the conclusion that, as a general rule, very little benefit was derived by carburetting gas directly in this way. The second division of the paper dealt with enriching gas by superheated hydrocarbons, which, under ordinary circumstances, would condense and form portions of the tar. This was the Dinsmore process, about which he need not stop to say anything. Then came the method of enriching a poor gas by highly-carburetted water gas; and this was a matter which he believed had not yet been studied in this country as it should be. The conditions had not yet occurred in England, as they had in America, rendering it absolutely necessary; but they ought to be considered carefully, if only with a view to meeting temporary emergencies, such as strikes, fogs, &c. He thought there must be yet a good deal to learn with regard to this third division; and he was glad to hear that it was being taken up in some large works which could afford to experiment with a view to solving difficulties, instead of leaving the work, as was too often the case, to be done by provincial gas companies. Professor Lewes had referred to one particular process—the Lowe—which seemed to have taken hold in this country, as it had in America, where it was very largely used; and, as far as his (Mr. Valon's) information went, it was certainly the best. He inspected the Van Steenbergh process when it was at work in England, and was very much fascinated with it. But he then pointed out what seemed to him might be a possible difficulty—viz., the lowering of temperature by continuous working; and he believed this had proved a difficulty which had not yet been removed. He should be inclined to adopt almost without question what Professor Lewes had said on this point; for he went into it very thoroughly, and almost lived on the works for a time. Reverting for a moment to the Lowe process, he had referred to the cost of 25-candle gas by that process as 1s. 8d. per 1000 cubic feet; but he (Mr. Valon) should think the price would be more like 2s. 8d. The oil was put down at 3¼d. per gallon, which might be correct, just as it was correct to say the price of cannel was 50s. per ton; but there were other matters to be taken into consideration. Cannel was a material which could be handled in precisely the same way as ordinary coal; but with oil a different set of conditions was introduced. There was nothing on the works to handle the oil with; and the mere price was not the only thing to look at. Cannel could be put into the retorts with the coal; but the oil could not. There must be storeage, and means for manipulation; and the facilities for delivery had also to be considered. If the works were upon a canal, the oil might be brought up in a tank barge; but then there must be something into which to pump it. Then, of course, they had to arrange for its flow back again for the purposes of the works. Again, if it had to be brought by rail, the difficulties were increased; and still more if the works were some distance from a railway or a canal. So soon as oil came to be used in sufficient quantity to be worth talking about, they would have to remodel the works and set up new plant; and he thought probably the cost of this would be half as much as that of the existing works, if not even more. There was no doubt that the presence of carbon monoxide in the water gas was a great drawback; and though Professor Lewes said there was no legislation at present forbidding the sale of illuminating gas with this constituent, he (Mr. Valon) did not think, seeing how particular Parliament was to protect the public against a few grains of sulphur, that there would be much likelihood of gas with this dangerous element in it being allowed to be sold without restriction. With regard to the last part of the paper, he must say he agreed with Professor Lewes in thinking that Dr. Thorne had over-estimated the illuminating value of oil gas as made by the Tatham process; but for the other details of the experiments, as given by Dr. Thorne, he was willing to answer, because he saw many of them carried out, and was quite sure they were correct. He had no doubt that if this system could be brought into use, something might be made of it. He might be expected to have some bias in favour of it; but he would nevertheless add that, in calculating the cost, the same considerations must be borne in mind as those to which he had already alluded in the other case—viz., that they must not be misled into taking the cost of oil as against that of cannel as the sole factor. He believed they would soon be able to know something practical about the cost of oxygenating oil gas; for he had heard that works were being put up at Huddersfield for making oxygen for purification, and leaving margin sufficient to deal with the oxygenation of a certain quantity of oil gas.

Mr. Harrison Veevers (Dukinfield) suggested that the Council might see their way to provide a loan apparatus such as that of which Professor Foster had been in need, for the purpose of conducting experiments which were of benefit to the whole profession. It came very hard on one gentleman to furnish such apparatus; and it did not look well to have to borrow from individuals.

Mr. W. H. Y. Webber (London) said that it was perfectly true, as Mr. Valon had remarked, that the price of oil was not the only factor to be taken into consideration in dealing with the question of oil gas as a carburetter; but this was an argument which, to some extent, cut both ways. In many respects oil was cheaper and easier to handle than coal, because it would run by itself where it was wanted. Anyone who wished to see how very easily, cleanly, safely, and comfortably oil gas might be made, could not do better than go and look at one of the Pintsch oil-gas works. He had inspected the last new one at the Great Northern Railway Station at Holloway, the other day, and was much struck with the general neatness and cleanliness of the whole arrangement. Mr. Valon said that the light hydrocarbons for carburetting under the Maxim-Clark process were generally added after the gas left the holder, which was quite true; but the bare statement in that form might leave a wrong impression as to the peculiar advantage of that apparatus. It was intended to be a corrective at the last moment. It was not designed for carburetting the whole of the gas, putting it into a holder and keeping it there until it was wanted. But, he took it, it was intended to deal with the flow of gas on the spot; and the great difference between that process and the common run of carburetters (as to which Professor Lewes had so strikingly said that the Patent Office was "strewn with their tombstones") was that in this only a very little carburetting material was used. It was only a question of improving the illuminating power of 16-candle gas by about 1½ candles, which was a very different thing from making a gas so rich that it was likely to deposit; and he had heard from a very competent authority that, with the small proportion used, there was practically no deposit at all in the syphons. Every member who had the opportunity should try a few of these experiments on the use of oil as a carburetter on his own account; for it was a subject which required to be studied more closely than it had been hitherto. He had found no difficulty in making gas from oil; but the great point to bear in mind was to be sure one did make gas, and not merely a vapourous body which would be certain to come down in liquid form very shortly if it was put into the gas. Oil might be turned into vapour with fatal facility; it could be done in a moment. But it did not follow that it was gas; and unless it was an incondensible gas which was put into the coal gas, it would come down sooner or later, and would carry with it some of the best of the coal gas, so that the last state of that coal gas would be worse than the first. Whatever was

used, whether a light volatile hydrocarbon or an oil which had to be first turned into a gaseous hydrocarbon by gasifying it with heat, the amount which was ultimately represented as gas was very nearly the same in all cases. If ordinary rectified oil was used, for every unit of weight one got about one-half in the form of gas; for instance, taking two gallons as the unit, one gallon practically disappeared in the form of tar, soot, &c. This being the case, it seemed to him there was something to be said for taking the lighter stuff as the carburetter to begin with, if it could be obtained at anything like a price. He would recommend them all not to be content with what they could hear about these things, but by all means to make oil gas and hydrocarbon gas themselves, with anything they could get hold of at all suitable for the purpose, and then they would understand a great deal more about it than could be gleaned from hearsay.

Mr. A. Edwards (Taunton) said the question was, when they did know all about it, how much richer the gas companies would be. His impression was that he could produce illuminating gas from coal as cheaply as it could be made by any of the oil-gas processes. He found no difficulty in making 15 to 20 candle gas from coal, provided he could get a proper selection; and although there was not much made out of residuals in the West of England, the gas cost him practically 1½d. per candle. The point which had been mentioned, about the necessity of a separate plant for oil gas, had occurred to him; and he could not see that in small works there was any money to be made by the process. Gas companies, or most of them, carried on business in order to make money; though happily a few also devoted themselves partly to carrying out experiments for the benefit of the rest. If they would be kind enough, at the conclusion of their experiments, to run out the figures, so that they might be criticized, everyone would be grateful.

Mr. C. Meiklejohn (Oldbury) asked if Professor Foster took any steps to ascertain the uniformity of the composition of the gas after the butylene was mixed with it. It seemed to him that, in adding so heavy a vapour as butylene, which was said to be twice the weight of air, to gas which was lighter than air, there would be great difficulty in securing uniformity after it was mixed in the holder. He did not understand if the gas was burned immediately after passing through the water-vessel, or if it was stored; and, if so, how long. Possibly the discrepancy in the results might be due to insufficient mixture.

Mr. J. Braddock (Radcliffe) asked what standard was employed in testing. If the candle standard was used, it might, he said, account for the somewhat erratic figures given in the table.

Mr. H. Ashton Hill (Wallasey) thought that there was some difficulty in reconciling the figures given in Professor Lewes's paper as to the cost of enriching 16-candle gas. He gave 4d. per 1000 cubic feet as the cost of enriching gas by cannel, bringing it from 16 up to 17½ candles. This came to 3s. 4d. or 3s. 6d. for 10,000 cubic feet. In his experience, he found he could enrich the same quantity of gas 4 candles for 3s. 9½d. This was a very considerable difference, which might perhaps be reconciled, but at all events it required consideration. He should like Professor Foster to give them the difference in illuminating power obtained by the Sugg improved Argand, as he understood that in one case it rose from 16·3 candles with the "London" Argand to 17·5 candles, and in another case from 16·6 to only 16·8 candles.

Professor Foster said these determinations were not made with the exactitude he should use if he were going to report to a local authority, when he should make a series of ten observations. In this case, three turns of the meter were taken to represent the volume of gas used; and he made perhaps half-a-dozen readings.

Mr. Hill said he understood, then, that these figures were not to be regarded as final. He did not think there was much practical importance in the difference observed between the flat part of the flame and the edge, because it was always understood that there was some 20 per cent. difference. They all knew that photometric results and commercial results were quite distinct things.

The President said the suggestion of Mr. Veevers was one which could be readily dealt with by the Council of the Institute when they met; and if they thought it of sufficient importance to adopt it, he had no doubt it would meet with the approval of the members. It did seem to him to be important to bear in mind that the cost of oil had not been ascertained until the cost of working had been added; and this meant, not simply providing pipes for the oil to flow in (which it would do with very little trouble), but also a considerable amount for storeage, if carburetting with oil gas were attempted on a large scale. Notwithstanding what had been said about the Maxim-Clark process, the facts were now pretty clearly ascertained, that this process as employed at the South Metropolitan Gas-Works did give reliable results, and that the 1½-candle gain sought to be obtained was substantially realized when the gas reached the consumer. The point in Professor Lewes's paper which would commend itself to everybody was the commercial summary, to which Mr. Edwards had referred. Of course, the figure of 4d. was one which might well be discussed. If it cost Professor Lewes 4d. for his cannel, it did not follow that it would cost this to everybody. He (the President) paid a great deal less to enrich his gas up to 20 candles than some of his friends did in the South. The point was the expense of cannel, as it could be purchased at any particular works, in comparison with other processes, the cost of which was given in the paper. Probably not everyone was interested in enrichment, because if the public were only entitled to have 15-candle gas, those who could supply themselves with coal from the nearest colliery which would yield this quality of gas, would never go to the trouble of enriching the gas, unless it were for the sake of enriching their own knowledge at the same time, by carrying out the experiments to which reference had been made. His own experiments in this direction were rather limited and crude—some of them being with the richer cannels, and some with oil; but he would not detain the meeting by alluding to them.

Professor Foster said it was a matter of very great regret that Professor Lewes was not present; and it was in no sense a detraction from the merits of his paper to say that it represented the work of a large number of individuals. Dr. Thorne's experiments on oil gas were scientifically of great value; and one could not help feeling that, if anything like the results claimed for that process could be realized, there was something in it. He was glad Mr. Valon appreciated the distinction between olefines and paraffins, because such mixtures as gasoline and the like, he believed, although he had had no actual experience, did vary greatly in illuminating value. Information occasionally filtered through to him which he did not always make use of; but he believed that many people had been trying to employ different liquids of all sorts and descriptions, as Mr. Webber had recommended. Results of very diverse character, and often most unexpected ones, were obtained. A distinguished chemist had a few weeks previously suggested the passage of a poor gas through tanks of gasoline to take out the lighter vapours which were objectionable in transit; and another gentleman, in the course of the same discussion, proposed the passing of a rich oil gas into the hydraulic main, although, of course, this oil gas was made from a substance containing scarcely any sulphur, and only a mere trace of any other impurities. With all deference to the eminent engineer and the distinguished chemist who made these suggestions, he thought they were both equally wrong. Each, of course, was entitled to his opinion; but they were absolutely divergent. The difference chemically between these two bodies, which were closely related, was not great, but the illuminating value differed very considerably. Mr. Valon, referring to the Dinsmore process, with which his (Professor Foster's) name had been connected, seemed to intimate that it was not really worth discussing; but he had never regarded it in this way. Whatever there might be in the process, which had for its object the raising of the gas-giving character of common coals, it was entitled to some consideration; and whatever the practical effect of the process might be in somewhat modified forms, he felt that there was something in it which had a scientific basis. He had been getting information about it from every possible quarter; and the consensus of testimony was that persons using it had at times obtained extraordinary results, but had never been able to maintain them. This seemed to show, not that it was a mere "fluke," but rather that they were as yet ignorant of the causes of failure. Of course, this did not alter the position. If it was not a process that could be put into the hands of ordinary individuals to work, it was not good enough for gas managers. But this question

ought to be kept distinct: Was it based on any scientific fact which might lead to the hope that it might be improved? His figures showed very clearly that if paraffins could be converted into olefines, their illuminating value would be doubled. How far this could be realized in practice was, of course, another question; and that was a point he had not touched upon—he left it for the Dinsmore people to show. He could endorse Mr. Webber's remarks respecting the use of gasoline; and he did not think the engineers who were employing it would continue to do so if it were not useful. In reply to Mr. Meiklejohn, he might say that the butylene was chemically examined, and the 86·8 per cent. was completely absorbed by fuming sulphuric acid. It was therefore presumably not a paraffin. He had also tested it in the ordinary eudiometric way, and the carbon always came out seven volumes of oxygen instead of six; so that it was not a paraffin. The object of the experiment was to see the result of mixing a certain proportion of the enricher with coal gas. He hoped to get some simple arithmetical proportion by which one could determine how much would be required to give a particular increase of candle power, and the same rule to apply all round. This was most important information if they could get it; but in this he had not succeeded—the proportion not being so simple as he had hoped. The gas used was permanent, he believed, at all temperatures above freezing, and at atmospheric pressure. If it were squeezed two or three atmospheres, no doubt it would condense. The mixture was going on all the time; so that he did not think there was any chance of stratification.

Mr. MEIKLEJOHN said the point of his question was whether the mixture was stored; as he understood that it was not.

Professor FOSTER said that the object of the experiment was to ascertain the rule, not whether one could make the gas and sell it. The standards used were the Methven screen and the 10-candle standard made by Mr. Sugg for the special purpose of testing large overhead lights; but he could transfer it to an ordinary bar photometer. The Methven screen was, in fact, used in nearly all the experiments. He quite appreciated Mr. Ashton Hill's remark that there was no advantage in determining the exact value of a low gas-flame, from a gas manager's point of view. But the light was certainly 20 per cent. greater from the flat of the flame than from the edge; and this was certainly a matter of some importance. They were not considering their obligation to the outside public, but estimating the lighting values of these mixtures; and a study of the figures would show that the average from a good flat-flame slit burner, did not differ very seriously from that with an Argand. He had only, in conclusion, to express his obligation to the South Metropolitan Gas Company and other friends who had assisted him in making experiments.

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Mr. A. T. WALMISLEY, M. Inst. C.E. (London), then read the following paper:—

## ON THE EFFECTS OF WIND PRESSURE ON RETORT-HOUSE ROOFS AND GASHOLDERS.

Retort-houses are, as a rule, placed in as sheltered positions as possible, more with the object of protecting the benches of retorts inside the building from wind currents than from any other consideration. Through retorts average 20 feet in length; and the roofs covering the houses in which they are placed are usually from 60 to 80 feet span. The slope given to the rafters is generally 1 in 1½—having a rise of one-third of the span; and this inclination gives an angle of from 33° to 34° with the horizontal. In "Iron Roofs" (2nd edition), published by Messrs. E. and F. N. Spon, the roof over the retort-house of the Tunbridge Wells Gas-Works is described on p. 8, fig. 20; and the details of the roof over the retort-house of the Dublin Gas-Works, which has a span of 64 ft. 3 in., are given in Plate XXI.

The loads upon a roof are partly permanent and partly occasional. The greatest accidental load of a statical nature which can come upon a roof is when it is covered with snow; and the greatest dynamical pressure, when one-half of it is exposed to the action of a violent gale. The former is provided for by making the framework and covering sufficiently strong in every part to sustain this maximum vertical load in addition to the permanent load of its own weight; and the latter, by a proper arrangement of bracing, to resist distortion under normal pressure.

The weight of snow varies in amount in different positions and localities. As in this country snow is not likely, in the presence of a strong wind, to accumulate upon a roof to a greater depth than about 9 inches, it is not necessary to provide for a heavier distributed load than 5 lbs. per square foot of horizontal area covered. Assuming snow to weigh 0·433 lb. per inch of depth on the surface covered, this would allow for an accumulation 11¼ inches deep. If it be argued that snow is heavier than the author has stated, then he replies that 5 lbs. per square foot is ample to allow, because, before the amount of wind force generally assumed for purposes of calculation can take effect, most of the upper surface of the snow would be blown off by the gale.

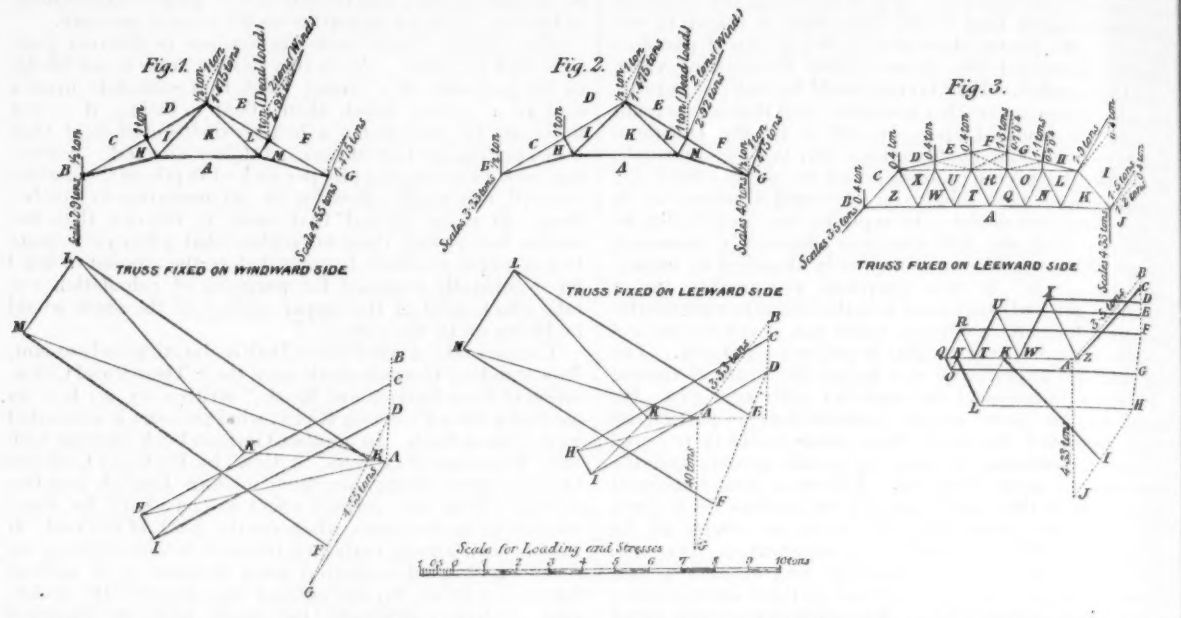
The pressure of wind varies both in duration and amount. In a standard German work upon the "Theory and Calculation of Iron Bridges and Roofs," written by no less an authority than Professor Ritter, wind pressure is estimated as a vertical load. In another German book dealing with the "Elements of Graphic Statics," by Professor Carl von Ott, the same divergence from modern English practice occurs. Thus the vertical effect is considered by these authors to be the same, whatever the pitch of the roof. It is true that, among early practitioners in this country, we find that Tregold estimated wind pressure as a vertical force; but in his day the subject was imperfectly understood. Now, although for small roofs in sheltered positions the result so obtained is generally in excess of practical requirements, we find in large and lofty iron roofs that the stresses due to wind pressure are affected by the circumstance that the maximum component of the wind's pressure can only act upon one side of the structure at a time. In the case of a roof, the wind curls up against the outside surface—producing a resultant pressure nearly normal to the side rafters. It is, therefore, the normal component that we require to know, because, since air is almost a perfect fluid, direct pressure can only be exerted in a nominal direction, and the tangential component is non-effective.

To resist the horizontal component of the normal wind pressure, the supports of a roof must supply horizontal reaction; and this horizontal reaction is, in the best constructions, transmitted to one side—leaving the reaction at the other support vertical only, and its bearing free to take up any expansion or contraction which may occur in the roof principals due to changes of temperature. In small roofs a certain amount of frictional resistance would be contributed at the free end by a sliding bearing. But in larger roofs with roller ends, the co-efficient of rolling friction is very small; so that the horizontal component at the unfixed or free end should, for purposes of calculation, be assumed to be zero.

The accompanying diagram [figs. 1 to 3 on the next page] shows that the most economical plan is to fix the side opposite to that upon which the heaviest winds are likely to blow. In this diagram the inclined dotted lines attached to the trusses represent the direction of the resultant pressure produced by the wind's force and dead load; and the lengths of the lines in the diagram of stresses indicate the respective amounts of stress in the different members of each truss.

In fig. 1 the truss is fixed upon the side exposed to the wind, and the stresses are seen to be considerably in excess of those in fig. 2, where the truss is fixed upon the leeward side; the data for loading and wind force being the same in both instances. The thick lines show the members in compression, and the thin lines those in tension; while the dotted lines exhibit the external forces. Thus it will appear advisable, when erecting a roof, to place the free end of the principals towards the greatest prevailing wind.

Fig. 3 is an outline of a new style of retort-house roof, erected at Portslade for the Brighton and Hove General Gas Company. It is no more than a Warren truss; the loads being brought upon it at the apices by longitudinal girders running the full length of the roof. These longitudinals hold up the rafter bars, which, in turn, support the purlins. The loading upon the truss is assumed to be practically the same as in the previous cases (figs. 1 and 2). It will be observed that the stresses are nowhere very great; but the members are numerous—showing that this system of trussing would appear to be very favourable




when a large span is necessary, and a flat pitch is not objected to. It would be an improvement to introduce transverse wind bracing between the longitudinal girders, as shown in dotted lines. This would make the whole elevation, as seen in fig. 3, a more complete truss.

It is usual to brace large iron roofs diagonally, to enable them to resist the effects of the wind blowing at an angle with the axis of the roof in an oblique direction. In many roofs these wind ties are spread all over the structure, as in the St. Pancras Station of the Midland Railway. In the roof over the Edinburgh Drill Hall, designed by Mr. R. H. Bow, the diagonal wind bracing is confined to bays next each end bay; the lateral stiffness of the six intermediate and of the two end bays being secured by their purlin connections. In the roof over the Carlisle Markets, the wind bracing is limited to the side spans. The centre span, being sheltered, does not need the diagonal bracing. (See "Iron Roofs," 2nd edition, Plates XL. and XLI.)

A gasholder is a floating vessel dependent for its stability upon external framework. The holder consists of a flexible skin of plates, strengthened at the rim by a certain number of annular rings and vertical stiffeners, both of which are introduced to obviate distortion. Assuming the external and internal pressures upon any bay to be the same locally between any pair of internal supports, the plate has a natural tendency to flatten or spread out by the pull of the adjoining plates; and hence the stiffening pieces must be spaced sufficiently near one another to prevent this. At the same time it must be remembered that all additional material within the bell tends to increase the backward pressure; and therefore, although, structurally speaking, it is a matter of indifference whether the required stiffening be in the holder or in the framework, it is preferable to place as little material as possible in the moving and working parts of the holder, and transfer it to the fixed and stable guide-framing. For this reason, in large gasholders, untrussed crowns are generally adopted. In a trussed crown, also, the centre of gravity becomes raised more above the centre of buoyancy of the inner lift than when the crown is not trussed. The centre of buoyancy is considered to be coincident with the centre of volume, and is the centre through which the lifting action of the gas operates vertically upon the crown of the holder. The segment of a sphere being theoretically the only perfect shape for uniformly distributed stress, an arc of a circle is the proper shape for the section of the crown. But the pull of the crown sheets, varying in intensity with the pressure of gas within, acts upon the joints at the junction of the crown with the side sheets, and tends to distort the dome-surface of the top of the holder. This action can be mainly resisted by the horizontal arched ring connecting the top of the standards, when the guide-framing is carried up to the top of the holder; and if this outside ring is designed of sufficient strength to preserve the standards, under every variety of loading, in a true circle in plan, the standards may be assumed to be considered as columns fixed at the lower ends, and imperfectly fixed at their top ends. Sometimes Paddon's wind-ties are added at the top, which greatly assists this stability. The annular ring at the bottom of the holder, consisting of the foundation to which the framework is securely bolted, forms a rigid base for the connection of the standards; and it is very essential that the sufficiency of attachments of these standards should be secured at the base, especially if the top horizontal ring is only strong enough to resist distortion by the pull of the top sheets of the holder, without resisting the compression arising from the tendency to displace the tops of the standards by the action of other pressure.

In a gasholder designed by your Vice-President, Mr. W. A. Valon, at Ramsgate, each standard is widened out at the base of the guide-framing, and there anchored by six bolts. A somewhat similar arrangement, upon a larger scale, designed by Mr. Charles Gandon, one of your Past-Presidents, exists at the Lower Sydenham Gas-Works. The use of wrought-iron standards widened out at the base has rendered the old method of columnal framing almost obsolete, except for small holders.

An average diameter for a gasholder (say) for a town of the size of Carlisle, would be from 80 to 120 feet. At the South Metropolitan Gas-Works there is one 214 feet in diameter and 160 feet in height; and at Birmingham, a holder 236 feet in diameter. But these dimensions are likely to be exceeded; and this fact, coupled with the tendency to reduce the height of the guides, as now practised in gasholder construction, renders the consideration of the effects of wind pressure, in all its bearings, most important. The pressure of wind being usually taken as an absolute horizontal force, its amount is directly proportional to the vertical surface upon which it acts, and not, as in the case of water, an amount varying with the depth below the surface of the area pressed. So far as the sides of the holder are concerned, the pressure of the gas may be taken as always in excess of the lateral pressure of the wind; and hence the wind pressure does not cause the skin plates to buckle inwards. While, however, the gas pressure resists the tendency to buckle, it does not resist the wind pressure. The lateral strain produced by the wind must be provided for, chiefly by the stiffening of the intermediate annular rings constituted by the cup and grip connections of a telescopic holder, and by the annular ring at the base of the outer lift, in the centre of which base or foundation the fixed truss to receive an untrussed inner lift is built.

In figs. 4 to 6, the resultants of the radial presssure due to wind acting upon a semi-circumference are shown by comparing the length of O R, in figs. 5 and 6, with the length of a diameter to the same scale. In fig. 5 the tangential components are considered to be non-effective; and the result gives a proportion of two-thirds of the plane

surface as the effective width for an equal uniform pressure, as found stated in old text-books. But when, as in fig. 6, the tangential components are taken into consideration, the factor for a curved surface is reduced to about one-hal

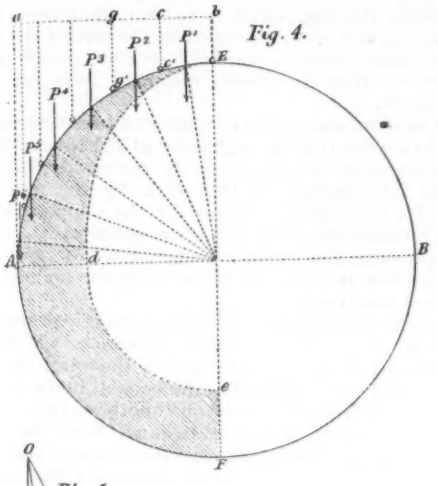



Fig. 4.

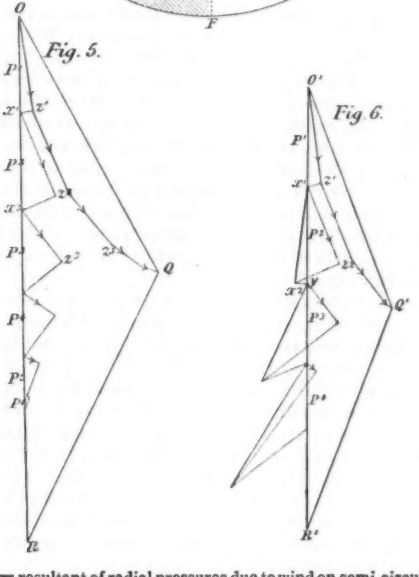



Fig. 5.




Fig. 6.

O R, fig. 5 = resultant of radial pressures due to wind on semi-circumference; the tangential component being taken as non-effective = 66 per cent. of plane surface A B (fig. 4).

$O^1 R^1$, fig. 6 = resultant of radial pressures due to wind on semi-circumference; the effect [of the tangential component of wind being considered = 56 per cent. of plane surface A B (fig. 4).

instead of two-thirds. Fig. 4 represents a gasholder, A E B F, divided into 24 bays. The wind pressure is taken as acting in the direction of the arrows at right angles to A B. *

Fig. 4 illustrates the resultant bursting pressure at different parts of the skin plates, which, under ordinary circumstances, has to be transmitted to the annular rings, and from these, through the rollers, to the external framework. Since a thin cylindrical vessel can only preserve its shape while the radial pressure continues uniform, it is evident, as pointed out in Mr. F. Southwell Cripps's practical articles upon the guide-framing of gasholders,† that "the entire abolition of guide-framing can only be made possible of success by adopting a special arrangement of tank guides and bottom rollers such as will secure a perfectly level and rigid base for the holder as it rises and falls;" and, further, "that, presuming the perfectly level working and rigid base (as attempted in Gadd's system) can be secured, there is still to be considered the tendency of the holder to distort out of the cylindrical form horizontally, which must be met by increased strength considerably beyond what is usual in the framework of the holder."

Mr. Cripps points out that single-lift gasholders cannot work safely without sufficient depth of guide-framing to preserve the level working of the holder, but that in the case of a three-lift holder, the inner lift may be safely left unguided by external framework, after it has cupped, provided the guide-framing is carried to the height of the two outer lifts; and he argues that the necessity of the guide-framing is shown by the fact that at least two tiers of rollers are necessary to be provided in the lower lifts. He shows that the depth of a lift should exceed one-seventh of its diameter, partly to economize the material required for stability, and partly to avoid trouble from the wedge-action of a holder of less height, similar to that produced in the elevation of a wide-fronted, but shallow and unbalanced window shutter. Also, that when these conditions are fulfilled, the inner lift cannot tilt, unless the moment of the resultant forces, including the resolved wind and snow pressures, exceeds the moment of leverage derived from the weight of the outer lifts which rest on the inner lift.

The tendency of the wind pressure is to lift the standards upon the windward side, and cause a compressive strain in those upon the lee side of the holder. The circumferential struts being generally too weak to resist the lateral compressive strain imposed upon them, the strains are transmitted from one standard to another by means of the diagonal bracing. Although the standards themselves usually possess an excess of strength, the structure would be in no small degree dependent upon the assistance of this bracing to preserve its integrity during a storm.

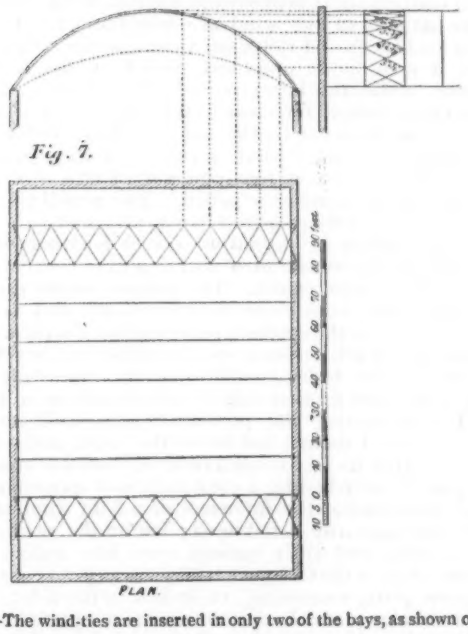



Fig. 7.

*Note.*—The wind-ties are inserted in only two of the bays, as shown on plan.

The diagram fig. 7 exhibits the introduction of diagonal struts as bracing between the vertical standards, as constructed in Cutler's system; forming a rigid circular framework in which the gasholder slides up and down. The uprights, being connected in short lengths at the intersections of the diagonals, are constructed of lighter sections than would be necessary in the case of standards where the connections of the bracings are further apart. The strain upon the foundation bolts is considerably lessened by the assistance contributed by the strutted bracing at the base; and any extra strain likely to be communicated to the bell from the effects of distortion of the guide framework, becomes reduced to a minimum. Messrs. S. Cutler and Sons, of Millwall, have constructed at Tunbridge Wells a gasholder upon this system, 112 feet

* The line *a b* is drawn parallel to A B, and lines *c* $c^1$, *g* $g^1$ are drawn from each bay to intersect *a b*. Then *c b*, *g c* . . . may represent the proportional amount of the pressures $P_1, P_2$ . . . &c. In fig. 5, from the point O, plot the values of $P_1, P_2$ . . . $P_6$, and resolve each separately into a radial and tangential component by drawing O *z* in a radial direction, and *z x* in a tangential direction. We thus obtain O $z_1$ $z_2$ . . . $z_6$. Join O Q, and O Q is the resultant of all the radial forces acting upon the quadrant A E. The tangential component being in this instance non-effective, there will be another resultant from the radial forces on the quadrant E B. Therefore draw Q R = O Q; then O R will be the total resultant of all the radial forces produced by $P_1 P_2$ . . . $P_6$. But since the tangential component of the force in one bay makes an acute angle with the direction of the force $P_1$, as applied to the next bay, it is more correct to consider its effect as in fig. 6. Hence the comparative resistance of a flat and cylindrical surface to wind pressure is seen to be one-half that presented by a plane surface having a width equal to the diameter of the cylinder.

† See JOURNAL, Vols. L., LI., and LII.; or "The Guide-Framing of Gasholders," by F. S. Cripps.

in diameter; and the diagram is a copy of a drawing made by them for a two-lift gasholder 212 feet in diameter, and rising 110 feet. A larger surface compared with the diagonal tie system is exposed to the wind by the diagonal struts when the upper lifts of the gasholder are not inflated. While nothing definite can be stated under this head, it might be safely assumed that an allowance of one-ninth, or one square foot per square yard of total vertical surface, measured diametrically, will be an ample allowance in such a case for the amount of surface presented to the wind by the vertical standards and strutted bracing. The effects are, however, covered by the provisions of strength to resist the wind pressure upon an elevated holder.

There are three different systems of transmitting pressures to the vertical standards. The first may be designated the tangential system; the second, the radial system; and the third, the skew system. The amount and distribution of pressure over the several standards will depend a good deal upon the contingencies of workmanship, and the amount of "play" allowed for the elastic nature of the iron and the effects of temperature.

Although a great number of experiments have been made to determine the maximum pressure of wind that has occurred, or is likely to occur, in this country, results vary very much; and the records of anemometers, as at present obtained, are very conflicting. It is recorded in an old Cambridge book (Vince's "Hydros," 1806), published at the commencement of the present century, that, from repeated observations upon the motion of light downy feathers, Dr. Derham estimated the maximum velocity of the wind to be 60 miles an hour; while Mr. Brice found, by observing the shadow of a cloud over the earth during a great storm, that the wind travelled at the rate of 63 miles an hour. The former experiment made no allowance for the irregular path followed by the feathers, which would not travel in a straight line; and the latter observation assumed that the clouds moved just as fast as the wind.

The mathematical instruments employed for indicating the fluctuations of the wind are very limited. The best known are Osler's and Robinson's anemometers; the former giving a continuous graphical record of direction and pressure, while the latter records its velocity. At the Royal Observatory, Greenwich, the changes of wind are recorded in direction by the aid of a large Osler vane, from which a vertical shaft proceeds to the registering-table, and gives motion, by a pinion fixed at its lower end, to a rack-work carrying a pencil. The pencil traces its marks over specially prepared paper, attached to a drawing-board, which is caused to travel horizontally and uniformly by clockwork in a direction transverse to that of the motion of the pencil. The paper contains division-lines indicating transverse hour divisions, and is fixed with reference to the cardinal points of the compass. The instrument is rendered very sensitive to fluctuations of wind pressure by the bearing-collar upon the vane-shaft being fitted with anti-friction rollers, which run in a cup of oil. For registering the pressure, a plate, with its plane vertical, is fixed about 2 feet below the vane, and revolves with it, so that its face is constantly presented to the wind. This plate is attached by a combination of springs in such a way that, under the influence of a light wind, slender springs are primarily acted upon; but as the pressure increases, other and stiffer springs come into action. The pressure-plate at the Greenwich Observatory was originally a square plate, measuring 12 inches in the side; but in 1866 a circular plate, having an area of 2 square feet, was substituted, and employed until the early part of the year 1880, when a circular plate, having an area of $1\frac{1}{3}$ square feet, was introduced. The distance to which the pressure-plate is driven back on the springs is communicated automatically to a pencil, and the record preserved on the paper. The influence of the size of the area of the disc exposed to the wind upon the result registered, is explained by the fact that the filament of the current of air next the edges of the exposed disc can only produce a partial effect, and the larger the area of obstructing surface, the smaller will be the proportion of the perimeter to this area.

Various improvements have from time to time been made in the gearing of the Osler form of instrument, to secure a more complete sympathy between the action of the outside pressure-plate and the registering-pencil. The extreme pressures sometimes recorded by pressure-plates may be due to the momentum of the plate carrying the index beyond its proper place. It being essential that the machinery between the springs at the back of the pressure-plate and the registering-table should be sufficiently delicate to be influenced by moderate pressures upon the exposed surface of the plate, the apparatus is liable to irregular action in excessive gusts; and the continual exposure of the springs to the weather, in old forms of this instrument, affects their elasticity, so that the results obtained have not always been reliable.

Prior to 1882, maximum pressures of 50 lbs. or more per square foot were at times registered at the Royal Observatory, Greenwich—a comparatively sheltered place. But since the introduction, in that year, by the Astronomer Royal, of a brass flexible chain for the copper-wire connection hitherto attached to this anemometer, the greatest annual pressure has varied from 14·5 lbs. in 1890 to 31 lbs. per square foot in 1888—the latter being the highest record of the last nine years.

Robinson's anemometer is the best practical instrument at present in use for recording velocities. Motion becomes imparted by the pressure of the wind upon four hemispherical cups situated at the ends of horizontal bars, which are constructed to cross one another at right angles; the cups being fixed at a given distance from the vertical axis of rotation. At the Royal Observatory, Greenwich, these cups are each 5 inches in diameter, the centre of each cup being 15 inches from the vertical axis of the instrument. The foot of the axis is a hollow, flat cone bearing upon a sharp cone, which rises from the base of a cup of oil. An endless screw acts upon a train of wheels furnished with indices, which are constructed to register the velocity of the air in miles, and a pinion on the axis of one of the wheels causes a rack to move upwards. To this rack is fastened a rod leading down to a pencil, which traces marks upon specially prepared paper. The registering-paper is placed upon a vertical revolving cylinder driven by clockwork.

The results are found to vary with the size of the cups and the radius of their revolving arms. The cups revolve with a velocity less than that of the wind; and hence the rate of the velocity of the cups has to be multiplied by an assumed factor to determine the required velocity of the wind. In most instruments the dial at the foot of the instrument registers three times the velocity of the cups; but it should be observed that, while this factor is not far from the truth in dealing with low velocities, there is an error of about 20 per cent. in the case of high velocities—recent experiments having demonstrated that a factor of 2·4 gives in such instances a more reliable result than a factor of 3.

Anemometrical observations, whether of pressure or of velocity, are seriously affected by the position of the instrument used. Eddies may be produced by the walls of a building; or with a large exposed surface, a cushion of air is formed which tends to distribute the pressure. Furthermore, the irregularities of the earth's surface tend to produce inclinations in the air currents. This is evident to any one walking along the windward side of a cliff, where comparative protection from the wind is experienced, while at some distance out its full force would be felt.

Both Osler and Robinson's instruments register only the horizontal components of pressure and velocity; but it is clear, from the above considerations, that the wind does not always strike a pressure-plate at right angles to its surface, except at great elevations or over extensive plains, where the wind currents would have an unimpeded course. The presence of ravines causes a rebound, and produces a vertical action which cannot be disregarded.

Professor Wild's pressure-gauge, which is in use on the Continent more than in this country, consists of a rectangular plate hung upon hinges, and attached to a horizontal axis. The force of the wind is indicated by the angle which the pivoted plate makes with the vertical. An ascending current strikes the plate almost at right angles, while a descending current will meet it at an acute angle, and this angle is much influenced by the weight of the plate; so that the results given by the instrument can only be usefully compared in the case of moderate winds.

A balance-vane, having both vertical and horizontal plates mounted upon a horizontal axis, and connected by gearing to an indicating-pencil and sheet of paper, was devised by Dechevens, a French experimentalist, for graphically exhibiting the direction of air currents; but

this instrument did not attempt to record either the wind's velocity or its pressure.

In Casella's instrument, the movements of the wind in every direction, including the vertical and horizontal pressures, are recorded continuously upon one sheet of paper. The objection to springs, above alluded to, in this apparatus, is obviated by the substitution of a plunger in a cistern of mercury for receiving the pressure of the wind transmitted by the outside plate. The vane consists of a pair of diverging blades fixed to a cap, mounted so as to rotate about a vertical axis, and constructed so that the pressure-disc, which has an area of 1½ square feet, will always maintain its surface truly at right angles to the direction of the wind. The motion of the vane is transmitted by a vertical tubular shaft to the registering mechanism. A detailed account is given in the specification of Louis Marino Casella, dated Dec. 30, 1882 (No. 6240). The action of Casella's instrument is unique, inasmuch as the author is not aware of any other which indicates both the pressure and direction of the wind in all directions, upon a reliable principle of investigation. In its construction, almost all the moveable surfaces run upon rollers; and all the moving parts are carefully counterbalanced by moving weights, so that they readily adjust themselves under any deviation from their normal position. While Robinson's instrument only gives average velocities for (say) five minutes, and the Osler instrument is capable of recording gusts of a few seconds' duration, Casella's pressure instrument registers minutely the results of deviation in vertical direction.

No velocity anemometer has yet been brought forward that has proved itself sufficiently sensitive to indicate an increased velocity extending only over a few seconds of time. Furthermore, the greatest moment produced by the wind upon a Robinson cup does not occur when the arm is perpendicular to the wind's direction, but at times when a considerable inclination transpires.

Experiments were made by Hutton, with the aid of a whirling machine, in which he estimated the average amount of horizontal unit force for different angles of inclination presented by an oblique surface; and in Vol. XLVIII. of the Proceedings of the Royal Society, there is a paper by Mr. W. H. Dines, B.A., dealing further with this subject. Mr. Dines employed a large whirling machine erected at Hersham, near Walton-on-Thames, in which the moment of leverage due to the wind upon a pressure-plate 1 foot square was balanced by the moment of the centrifugal force caused by the vertical circular motion acting upon a transverse bar. Trials made with the plate exposed to the wind in various positions (its plane always remaining vertical, but inclined to the wind's direction at different angles), showed that the tangential component was insignificant in comparison with the normal.

Mr. Dines states that he found damp air conducive to a high, and dry air to a low relative pressure, and that a decrease of pressure per square foot occurs as the size of the plate is increased. Also that with the use of a narrow, long vane, instead of a square plate, whether the shorter or longer axis be inclined to the wind, the unit pressure was comparatively in excess of that on the square plate.

Whatever form of instrument is employed, the experimenter must bear in mind that all automatic machinery requires occasional examination and periodical cleaning. Some observers quite overlook this fact, and seldom do either until the instrument either breaks down, from its delicate constitution, or else sticks fast and refuses to operate. The indications from such neglected instruments ought not to be trusted for the years when this has been the case; and yet at times we find the results printed and published without note or comment.

At Bidston Observatory, near Birkenhead, a pressure of 80 lbs. per square foot has been recorded by an instrument situated upon a hill 260 feet above Ordnance datum, two miles distant from, but directly facing, the Irish Sea. The gale which destroyed the Tay Bridge was calculated, from observations made at Glasgow, to be 42 lbs. per square foot. Now, although it may be argued that heavy gusts of wind are generally very limited in extent, yet it must not be forgotten that, when such gusts occur at frequent and regular intervals, they tend to cause a floating structure like a gasholder to sway; and that, while a registered velocity of wind might have been allowed for in calculating the stability of a structure, a sudden gust of whirling and upward motion might produce injury, if not an overthrow. It is clear that a steady velocity of (say) 20 miles an hour, raging for the period of an hour, would do no harm, but that a gust of 60 miles an hour, lasting only for a single minute, might effect considerable damage; and yet the two records might not be distinguishable from each other, so far as the instrument that was employed for registering the mean velocity is concerned. The author therefore considers records of pressures to be more valuable to the engineer than records of velocities.

The velocity of the wind in the higher regions of the air is greater than near the sea-level. Some experiments were made at the Eiffel Tower, in Paris, which showed that the velocity of the wind increases to the extent of 33 per cent. for every height of 100 feet, up to 1000 feet, the height of the tower. Mr. C. Douglas Archibald stated, in an article in *Nature*, on Jan. 11, 1883, that if $h$ and $v$ represent respectively the height and velocity at the lower level, and H and V those at the upper level, then the velocity of the wind at any required height may be approximately calculated from a registered velocity, at a stated height, by the use of the following formula:—

$$\frac{V}{v} = \sqrt[4]{\frac{H}{h}}$$

Sir Benjamin Baker has stated that he has come to the conclusion that uniform velocity and pressure in a wind, whether it prevail or not at cloud heights, can never occur near the surface of the earth, or in the neighbourhood of any structure capable of causing eddies. Unsteady motion must be the rule in air as in water; and the threads of the currents moving at the highest velocity will strike an obstruction successively rather than simultaneously, so that the mean pressure per square foot will greatly vary.

An approximate mean pressure may be calculated from a mean velocity, found by experiment; but it is impossible to calculate the maximum pressure in this way. While it has always been acknowledged that the unit pressure varies as the square of the velocity, it appears, from Mr. Dines's most valuable experiments, that when P = the unit pressure in pounds per superficial foot, and V = the mean velocity in miles per hour, $P = 0{\cdot}0029V^2$, and not $0{\cdot}005V^2$; so that the constant of 1-200th hitherto recommended is too high. A pressure of 1 lb. per superficial foot is produced by a velocity of 18¼ miles per hour. The annexed table gives a comparison of results obtained by a velocity instrument, with equivalent pressures, based on values corrected by the use of Mr. Dines's constant.

*Comparison of Results by Robinson's Velocity Register, with Equivalent Pressures.*

| Average Velocity of the Wind. | | Perpendicular Pressure in Pounds per Foot Super. | Characteristics. |
|---|---|---|---|
| Miles per Hour. | Feet per Second. | | |
| 1 | 1·47 | 0·003 | Scarcely perceptible. |
| 2 | 2·93 | 0·012 | Calm. |
| 3 | 4·40 | 0·027 | |
| 4 | 5·87 | 0·048 | Gentle breeze. |
| 5 | 7·33 | 0·075 | |
| 10 | 14·67 | 0·300 | Brisk gale. |
| 15 | 22·00 | 0·675 | *Note.*—A pressure of 1 lb. per foot super. is produced by a velocity averaging 18¼ miles per hour. |
| 20 | 29·34 | 1·200 | Fresh gale. |
| 25 | 36·67 | 1·875 | |
| 30 | 44·00 | 2·700 | Strong gale. |
| 35 | 51·34 | 3·675 | |
| 40 | 58·68 | 4·800 | Hard gale. |
| 45 | 66·01 | 6·075 | |
| 50 | 73·35 | 7·500 | Storm or tempest. |
| 55 | 80·66 | 9·075 | |
| 60 | 88·00 | 10·800 | A great storm. |
| 80 | 117·36 | 19·200 | Hurricane. |
| 100 | 146·70 | 30·000 | *Note.*—A pressure of 28 lbs. per foot super. is produced by a mean velocity of 96·6 miles per hour. |
| 125 | 183·33 | 46·875 | Hurricane equal to that which no canvas could withstand. |

The Board of Trade required a wind pressure of 56 lbs. per square foot to be provided for in the design of the Forth Bridge. During the time of a severe gale, 27 lbs. per square foot was recorded upon a large board 300 square feet in area; while 41 lbs. and 35 lbs. respectively were recorded upon two smaller boards 1½ feet square—all being

placed upon the Island of Inchgarvie. An average pressure of 32 lbs. per square foot was registered at the other portions of the bridge. In this country it is sufficient to allow for a lateral pressure of 40 or 45 lbs. per square foot of vertical surface directly opposed to the action of the prevailing wind, as the equivalent of horizontal wind force acting broadside upon any structure.

*Discussion.*

The PRESIDENT, in opening the discussion, said the Institute were indebted to Mr. Walmisley not only for his excellent paper, but for the gift to the library of his work on "Roof Construction."

Mr. W. A. VALON said the paper just read was one of the most comprehensive on the subject dealt with to which he had ever had the pleasure of listening. The President, who happened to meet him in London, mentioned this paper to him, and asked him to put himself in communication with Mr. J. Glaisher, F.R.S., who was an authority on wind strains. He did so, and also had the pleasure of meeting Mr. Glaisher a few days afterwards at a meeting of another Association, when he said he should be pleased to furnish any information he could for the use of the Institute. Mr. Glaisher had given him a copy of a paper he had read before the Meteorological Society, comprising his observations on wind pressures made over a period of twenty years at the Royal Observatory. He (Mr. Valon) would hand it to the President, so that it might be incorporated in the Transactions of the Institute. One table gave the observations of maximum pressures during the period mentioned, from which it appeared that the greatest pressure experienced was when the wind was blowing from the west—viz., 28 lbs. per square foot. He had been much struck with the fact that the author drew attention in his paper to the errors of former observers, who had put it as high as 80 lbs. per square foot. But it appeared, from a note to one of the tables, that a pressure of 28 lbs. was produced by a mean velocity of 96·6 miles per hour; and he seemed to give this as a maximum, which agreed exactly with the observations made by Mr. Glaisher. The other pressures given by Mr. Glaisher were: S.W., 25 lbs.; W.S.W., 25 lbs.; S.S.W., 24 lbs.; N.E., 21 lbs.; S., 16 lbs.; W.N.W., 15 lbs.; N., 15 lbs.; E.N.E., 14 lbs.; N.W., 12 lbs.; E., 9 lbs.; S.S.E., 7 lbs.; N.N.W., 6 lbs.; S.E., 6 lbs. There was no pressure up to 5 lbs. from either of the two remaining points of the compass—N.N.E. and E.S.E. During the twenty years, pressures up to 5 lbs. were recorded in 160 months. These figures gave just the information which engineers wanted—viz., the maximum wind pressure with which they had to contend.

Mr. W. GADD (Manchester) said that the paper was a most exhaustive one; but the author did not give the wind pressures as the result of his own experiments. With regard to the method of treating the pressure of the wind as a vertical force, as employed by certain German authors, he was by no means convinced that this was the proper way of dealing with the subject; and as to the direction of any force on a structure, it was not clear that the correct method was arrived at, even by the best-known means. A number of experiments which he had made tended to show that the direction of any strain or force generated within a structure was mainly the result of the mode and direction of the resistance at the point where it was secured; and he found that, by altering these, the direction of the internal strains could be changed to a large extent. This was a subject that required further investigation. The portion of the paper which had most interest for himself was that which referred to wind pressure on gasholders. In dealing with gasholders of the ordinary construction, he did not know that he should differ at all from Mr. Walmisley; nor was there anything with which he desired to find fault. But when the author spoke about the entire abolition of guide-framing, he said it could only be made a possible means by the adoption of "a special arrangement of tank guides and bottom rollers, . . . such as had been attempted in the Gadd system," for securing a perfectly rigid base for the holder; and that, presuming this was done, there still had to be taken into account "the tendency of the holder to distort out of the cylindrical form horizontally, which must be met by increased strength considerably beyond what is in the framework of the holder." There were two words there which were perfectly right when they were written; but, in the light of subsequent events, might require to be amended. The word "attempted" might now be struck out, for it had been accomplished; and, from some hundreds of experiments, the results of which he had been looking at very closely, he thought that the word "considerably" was scarcely warranted by the facts. Great increase of strength was not required; though, of course, an engineer might put in any extra strength he thought necessary. He was much interested in the subject of wind pressure, having, since 1861 or 1862, made many hundreds of experiments upon it; and he had worked upon it in conjunction with the late Director of the Meteorological Office, Admiral Fitzroy. One of those experiments he might refer to, as it seemed to bear on the subject of gasholder construction. Mr. Walmisley had mentioned the plate gauge for measuring wind pressure. Behind this plate he placed a number of thin glass rods, at a distance of from $\frac{1}{16}$ to $\frac{1}{8}$ inch; and the point to be noted was the different effect upon these rods when the wind was steady, and when it came in gusts. He found that the rods which were placed horizontally were smashed to pieces by a comparatively small pressure when it was intermittent; but when it was steady, they would sustain, without injury, a pressure much greater than would have been supposed. This was only what might have been expected, considering the frangibility of the glass; and he had recently repeated the experiment with several substances of a comparatively brittle nature, and found a like result. His opinion, therefore, was that a gasholder guided by columns in the ordinary way, might receive a series of blows which would do it damage, even from a wind of no very excessive force; and this might account for a great many catastrophes which took place under wind pressure, when the gauges had not recorded anything apparently dangerous. Taking this into consideration, he could not come to the conclusion at which the author seemed to have arrived—that a gasholder without guide-framing would be far more subject to the evil effects of the wind than one with such guides. If he referred to a holder having a third lift without framing, and the rest guided by framing, he (Mr. Gadd) could agree with him; but if he meant a holder secured properly at the base, he did not think the remarks would quite apply. At any rate, the matter required further attention and experiment. As to Osler's cups, many years ago he (Mr. Gadd) came to the conclusion that they could not be depended upon for anything like accurate registration, for several reasons—one being their angular action. It was only at one point that the cups received the direct rectangular force of the wind; and, as they revolved, they lost this by degrees. This had to be arranged for, and a factor for correction brought in which was of a somewhat arbitrary character, arrived at by calculation. One other point was important. In dealing with a plate-pressure gauge, there was the rush over the edges, which was a very important factor. In the semi-circle of a cylinder exposed to the wind, there was not that same rush over the edges, as there was over the curve of the material, which somewhat modified it. This had something to do with determining the true ratio of pressure on a cylinder as compared with a plane surface. Mr. Walmisley showed that if the tangential components were brought in, the result was very different from what it was when they were left out. But although it was generally admitted to be 0·56, he was not quite clear that this was really accurate; he fancied there were some other conditions which had to be attended to. However, for all ordinary purposes, taking half the plane area was quite satisfactory.

Mr. J. CHEW (Blackpool) remarked that the construction of roof shown in figs. 1 to 3 was somewhat peculiar. He presumed it could be adopted for a roof two or three times the size; and it seemed to him that the cost would be from 30 to 40 per cent. less than that of some of the other types. Mr. Walmisley's book, which was the most valuable one on the subject, would be a great acquisition to all gas managers, though, as far as he was aware, gasholders were not mentioned in it. It would confer an additional benefit on all the members if the author would say which type of roof was the simplest and safest; because they had to consider economy as well as beauty of construction.

Mr. T. O. PATERSON (Birkenhead) asked if an experiment had ever been tried of fixing a wind-gauge to a locomotive engine. If the air were perfectly calm, and the speed of the engine were known, it occurred to him that, with the locomotive going at a great pace, very valuable data would be obtained.

The PRESIDENT, in calling upon Mr. Walmisley to reply, said his paper would form one of the most interesting that had ever found its way into the Institute's Transactions, and would well repay careful perusal.

Mr. WALMISLEY, in reply, said the records brought before the Meteorological Society by Mr. Glaisher, and communicated by Mr. Valon, were of the highest importance, and showed that the allowance made for wind pressure in construction had been generally much overrated. At the same time, it was always necessary to leave a margin for imperfect workmanship and material; and therefore the factor of safety ought not to be too much reduced. He was very pleased to make the acquaintance of Mr. Gadd; and, of course, no one would dispute his statement that, by altering the mode of resistance, one could alter the mode in which the internal strain was taken. At the same time, they knew that the wind blew in all directions; and one side must be made as strong as another. He fully agreed with Mr. Gadd that the word "considerably" required some explanation. He had used it in quite a comparative sense; and it *was* considerable when compared with the weight of the plates which formed the outside of a gasholder, which were very slight in comparison with those used in other engineering constructions. He did not allude to Mr. Gadd's inclined guides, which, no doubt, were excellent in their way, because he had not had any experience of them. Mr. Gadd said a holder guided by vertical standards would receive a series of blows; and he probably meant it to be inferred that in his system without the standards there were no outside influences to resist these blows. At the same time, although there were no outside standards, if the holder consisted of more than one lift, there was a continual blow brought by the action of the wind on the cup-and-grip connection on the windward side. He concluded that Mr. Gadd would construct a gasholder with his inclined guides at the base, of two or three lifts, whatever the opinion of other gas engineers might be as to the advisability of such constructions. There was no doubt that the most serious component of the strain from wind pressure with which they had to deal was the normal action on the side; and, taking this into consideration with the snow on the top, one had a resultant action which was resisted by the weight of the upper lifts on the cup-and-grip connection. With regard to Mr. Chew's question as to types of roofs, he did not consider the Tunbridge Wells system an economical construction, because the curves led to increased expense; and he looked upon straight rafters as being in every way suitable, as in the Dublin system, for a roof covering a retort-house. In that case there was a proper slope for a slate covering, which was generally adopted in such buildings. There was a simple slope; and then, in the event of the introduction of curved members of the principal, if it should be required to hip the roofs at the end, the vertical members would fit in better with the hip construction than the system of putting struts at right angles to the rafters, as shown in figs. 1 and 2. At the same time, it was well known that the shorter the struts were, the better; and if the roof was not to be hipped, it was advisable to put struts at right angles to the rafters, because they connected more efficiently and were shorter. They were also placed at a more favourable angle for resisting strains than when vertical near the side wall, as in the Dublin system. In the roof used for covering the Carlisle Market, the form was such that the curve of equilibrium under the loading fell entirely within the wrought-iron top members of the principal; so that the whole of the bracing of the roof was in tension. Even the strut at right angles to the principal was in tension, although he had made it look as if it were in compression, because he knew people would not believe it was in tension if he left it simply as a round bar. Of course, in compression members, it was desirable that they should be as short as possible; while tension members might be as long as one pleased, provided they were simply coupled up for taking the tension without bringing undue strain on the parts connected. He agreed that it would be exceedingly interesting to attach a registering apparatus to a locomotive, as Mr. Paterson had suggested; only, according to the way in which railways were laid out, in order to avoid interfering with property, the lines twisted about in all manner of directions. Therefore the wind pressure would be coming at one time at a certain angle, and at another time at quite a different one; and this would make it rather difficult to record the results. If one could have a locomotive running on a viaduct, or on a high bank which was continuous in a straight line for some length, the record of such a registering medium would be exceedingly valuable—of course, making due allowance for the speed of the train. But where the train, as in most English systems, had to keep following a circuitous course, the variation allowance that would have to be made for this would be so complicated, that it would require the skill of a learned professor, or even more, to apply the coefficients necessary to make it of practical value for engineers. He begged, in conclusion, to thank the members for the kind welcome they had given him, and for the attention bestowed upon his paper.

Mr. D. B. PEEBLES (Edinburgh) said he believed many years ago the late Sir Daniel Gooch did make some anemometrical observations on the Great Western Railway. There was between Swindon and London a run of about 77 miles, which they used to do in 79 minutes; and this afforded a favourable opportunity for making such observations as those suggested. It was a long time ago, for he was then a boy in the engineering works at Swindon; and he could not remember what results were obtained.

Mr. GADD asked leave to explain that it was not at all his intention to attach greater importance to the vertical than to the horizontal component.

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Mr. W. R. CHESTER (Nottingham) read the last paper taken on the second day, entitled—

## ON SOME BYE-PRODUCTS IN THE MANUFACTURE OF COAL GAS, AND THE UTILIZATION OF THE SAME.

In the distillation of coal, it is now a well-known fact that the crude gases and vapours which leave the retort consist of various compound bodies containing all the elements necessary for the purification of the luminous gas; and that if these are properly manipulated, there is no need to call in the aid of any expensive outside materials. The oily vapours are separated by frictional condensation, and are readily conducted away by gravitation, the ammonia gases are soluble in water, and are almost as easily got rid of; leaving behind, as impurities, only the permanent gases, sulphuretted hydrogen and carbonic acid, and the sulphur-compound vapours to be dealt with. The sulphur-compound vapours are readily absorbable in the lighter hydrocarbons of the tar, and may be extracted by passing the gas through layers of sawdust saturated with them. But, unfortunately, this method of eliminating the impurity has the drawback that the luminous vapours of the gas are also abstracted. Consequently, it has not yet been possible to adopt this method with commercial success.

Great advances, however, have of late been made in purification, by utilizing ammonia for the complete elimination of the three impurities; and the ideal process of purification in closed vessels on a continuous system, which all gas engineers and gas chemists have for many years been eagerly looking forward to, is now more nearly within reach than it has ever previously been. The interesting experiments on the Claus principle now being carried out at Belfast, are being closely followed; and the results are somewhat impatiently awaited. When these are published, we may expect that this ideal form of purification has been carried a step nearer to success. No one doubts that it is possible to effect complete purification by means of ammonia when properly manipulated, and when the required proportions have been more accurately determined. When the impurities have by this method been fixed, it will be an easy matter to convert them into commercial products, instead of wasting them in lime as we do at present, and at the same time destroy another valuable article of commerce.

Taking the impurities in the crude coal gas produced from a ton of Midland coal as being approximately—

| | Lbs. | | Equivalent in Sulphur. lbs. |
|---|---|---|---|
| Sulphuretted hydrogen . . . . | 14 | .. | 13·17 |
| Sulphur compounds . . . . . | — | .. | 0·57 |
| Carbonic acid . . . . . | 28·5 | .. | — |
| Ammonia . . . . . | 6·5 | .. | — |

we have only one-sixth or one-seventh of the theoretical quantity of ammonia necessary to fix the above impurities. But we have only obtained from the coal about one-sixth of its total nitrogen in the form of ammonia; so that if we could recover the other five-sixths, we should have all the purifying material needed for the complete purification

of the gas, without having to resort to outside aid. As, however, the total nitrogen of the coal is not yet available, Mr. Claus (following the lines of the late Mr. F. C. Hills, but carrying the principle much farther) has succeeded in eliminating the whole of the impurities with ammonia. To do this it is necessary to accumulate a stock of caustic liquor—*i.e.*, liquor freed from the sulphuretted hydrogen and carbonic acid impurities—sufficient to absorb the whole of these impurities as they come forward with the gas. This is done with the aid of heat; the impurities being driven off from the liquor at a temperature of 180° to 200° Fahr., leaving the ammonia behind in a caustic or revivified condition, capable of again taking up and withdrawing these impurities from the crude gas. We have in this form of purification a means of utilizing all the ammonia, and making it, without much loss or expenditure, do all the purification necessary; while the surplus can be drawn off from time to time and converted into sulphate of ammonia. The sulphur impurities are broken up, and nearly the whole of the sulphur is recovered in a commercial form.

Where purification is not carried to refinement, and the sulphur compounds are ignored, it is possible to recover the sulphur as a bye-product, and at the same time save 3d. or 4d. per ton of coal carbonized, by fixing it in oxide of iron and using a small quantity of lime to abstract some of the carbonic acid. As, however, the object of manufacturers of gas should be to make the article as pure and good as science and skill will enable them to do, we may expect the ultimate aim will be to amplify rather than to curtail the process of purification, and make gas unexceptional in all respects.

From the above table it will be seen that there are some 13 lbs. or 14 lbs. of sulphur to be removed from the gas from a single ton of coal; and though this is, perhaps, a somewhat higher figure than many engineers have to deal with, it approximately represents the average in my own case. The question is, How much of this can be recovered in a commercial form?

Keeping the sulphur compounds in the gas uniformly below 15 grains of sulphur per 100 cubic feet, I use as much oxide of iron as possible, as a purifying material, and as little lime as will accomplish this end. The result is that we get

| | lbs. |
|---|---|
| In the ammoniacal liquor | 2 |
| In the oxide of iron | 7 |
| In the lime | 5 |
| Sulphur per ton of coal = | 14 |

Of the sulphur in the ammoniacal liquor, when the same is worked up into sulphate of ammonia, we recover 75 per cent., by the aid of the Claus kiln, in a comparatively pure form. Of the sulphur in the oxide of iron, when burnt in the vitriol furnaces, we recover 85 to 90 per cent. in the form of vitriol. This makes a total yield of rather more than 7 lbs. of sulphur recovered, in a commercial form, per ton of coal carbonized.

In order to work up the 6·5 lbs. of ammonia recovered, we require 18·7 lbs. of vitriol. But the 7 lbs. of sulphur recovered will yield 29 lbs. of vitriol; or about 11 lbs. in excess of the requirements. We may, therefore, sell the whole of the sulphur recovered from the Claus kiln, as it yields a high price, and utilize that in the spent oxide for vitriol making, which will give 22·7 lbs., or 4 lbs. of vitriol per ton of coal carbonized more than is required for the working up of the whole of the ammoniacal liquor. Now, 4 lbs. per ton on 140,000 tons of coal will yield 250 tons of vitriol per annum, to be utilized for other purposes than sulphate making. With a portion of this surplus vitriol, I manufacture new artificial oxide of iron. The sulphur impurities of the gas thus provide the whole of the vitriol for sulphate making, for manufacturing the whole of the new oxide required for purification, and leave a surplus, which is used up in connection with the process of tar distillation. Besides this, we have a certain amount of pure sulphur for sale, which is recovered from the Claus kiln.

It may be interesting to the members of the Institute to know something more of the manufacture of artificial oxide of iron and of its working capabilities, since it is a somewhat novel and unusual manufacture in connection with the gas industry. Light wrought-iron scrap is obtained; the lighter the better, provided it is clean and free from solder and tin. The lighter iron is generally the purest; and nothing is better adapted for the purpose than old preserved meat and fruit tins, provided they are first freed from the dirt, tin, and solder. This is dissolved in sulphuric acid in open lead-lined tanks, and the liquor concentrated as much as possible; the salts of iron, on crystallizing, being dissolved, before use, with the aid of steam. The iron liquor is then run into a tank of lime and sawdust. The sawdust should be obtained as dry as possible, and placed in a heap. Then powdered quicklime is riddled through a fine sieve over it; and the two are carefully mixed together in the dry state. The fine lime enters into the minute interstices of the sawdust, and a general shrinkage takes place; so that when mixed the bulk is something like 25 per cent. less than when the materials were measured separately. After being thoroughly well mixed in the dry state, and allowed to stand for a few hours, the iron liquor is run on to the point of saturation; the mixture being meanwhile turned about by the shovel until the whole of it has become thoroughly incorporated. The iron from the liquor is precipitated by the lime in a state of minute subdivision over the whole of the irregular surfaces of the sawdust. The mixture is then wheeled to a heap, and allowed to lie for several weeks, during which time it heats and dries. When required for use, it is turned over once or twice; the lumps are broken; and it is found to contain about 35 per cent. of moisture. On being placed in the purifier, it is very active, and takes up large quantities of sulphur from the first.

The advantages of making an artificial oxide yourself are that you know exactly what are the ingredients, and to what extent you can rely with certainty on its efficiency in the purifier. The cost of manufacture in my case is as follows: Iron, 2s. 8d.; lime, 1s. 6d.; sawdust, 2s. 9d.; acid, 4s. 7d.; labour, 4s. 6d.—total, 16s. per ton, containing 35 per cent. of moisture.

The work done by a 180-ton sample of natural oxide or Irish bog ore, and the same quantity of manufactured oxide of iron, is as follows, calculated per ton of oxide received:—

| | Bog Ore. | | Artificial Oxide. |
|---|---|---|---|
| New oxide received | 1 ton. | .. | 1 ton. |
| Percentage of moisture received | 55·77 | .. | 36·2 |
| Number of times fouled | 11 | .. | 11 |
| Coal carbonized, tons | 62·37 | .. | 197·89 |
| Gas purified, cubic feet | 620,389 | .. | 2,002,253 |
| Wages paid for eleven changes | 14s. 4·37d. | .. | 14s. 4·37d. |
| Percentage of sulphur when sold | 39·1 | .. | 42·7 |
| Percentage of moisture | 4·4 | .. | 5·4 |
| Weight of spent oxide, cwts. | 18¾ | .. | 32¾ |
| Amount realized for spent oxide when sold, based on 6d. per unit of sulphur contained | 18s. 9d. | .. | 34s. |

From these results, it is very apparent how desirable a thing it is, from a financial point of view, to cherish even the very impurities of the gas, since they may be converted into valuable bye-products. To reap the fullest benefit from their recovery, it is, however, essential that gas-works should not only work up their own ammoniacal liquor, but should each have their own acid plant; and be capable of using up their own spent purifying material, and of manufacturing new as required. The addition of these works to the gas plant will not involve a large expenditure, and will pay an enormous percentage on the outlay. By doing this the department will be able to work with the greatest economy, and will be better able to pay for, and secure, the services of a good man, than when gas only is made, and someone else reaps the profits on the working up of the residuals. Spent oxide, new oxide, and ammoniacal liquor, are all of so bulky a nature and low commercial value that any charge for carriage enormously increases their cost, and no one can possibly be one penny the better for it.

In conclusion, I consider it may be roughly calculated that, in works sufficiently large to do it, the acid can be manufactured at about half the cost at which it can be purchased, a higher price may be realized for the spent oxide, and new oxide may be made at something less than half the cost at which it can be purchased. The saving in carriage alone on ammoniacal liquor will represent from 4d. to 6d. per ton of coal carbonized when the liquor is worked up where it is produced.

*Discussion.*

Dr. Stevenson Macadam said the paper to which the meeting had just listened was a perfect model of what such a communication should be—concise, and yet thoroughly complete. The author had brought within a very

small compass most of the present knowledge with regard to the best methods of arresting impurities in gas. The subject was not yet complete; but enormous strides had been made with respect to the working out of these impurities. Contrasting the present paper with one which might have been read some thirty years ago, when tar and ammoniacal liquor, and all the abominations of a gas-works, went down the nearest stream, it would be found that great advances had been made. The most important part of the paper was that which dealt with the removal of the sulphur compounds from gas; and he was particularly struck with the success which had attended what Mr. Chester called his "artificial oxide." The natural oxide was of a rather hard and compact nature; but the author had succeeded in making a substance very porous in its character, which appeared to be efficient. It occurred to him that there was a somewhat parallel case in the use of bone ash for certain purposes, which were, however, quite different. Carbon had great power in taking up gases and affecting colours, and it was employed for this purpose; but if pure carbon, or even wood charcoal, which was somewhat porous, were used, its powers in this respect were rather limited. But bone ash—the carbon prepared from bones, which, when analyzed, was found to contain only 10 per cent. of carbon and 90 per cent. of earthy matter—was, he believed, far more beneficial than the pure carbon. He thought a satisfactory explanation of the great value of the oxide prepared by Mr. Chester might lie in the fact that it very much resembled bone ash material; and thus took up more readily a larger proportion of the sulphur compounds. Mr. Chester had also made allusion to the difficulty experienced up to the present time in obtaining the full amount of ammonia from coal; and he suggested that, if they could get more, it would be sufficient for the purpose of fully carrying out the purification process. It occurred to him that possibly gas managers might take a hint in this respect from what had been done lately in shale works in Scotland. It was known that during the distillation of oil from shale and the working up of the ammoniacal liquor, the amount of ammonia obtained, on an average, per ton of shale was equal to something like 10 lbs. of sulphate per ton. The coke derived from these shale works was now being used for heating retorts, either directly, or by converting it first into gas. Steam was passed through the coke, with the result that a large proportion of the carbon was converted into carbonic oxide, and at the same time hydrogen was produced (both useful for burning), and converted into the condition of ammonia a large proportion of the residual nitrogen left in the coke. The consequence was that in shale works under the charge of himself and his son, where they were previously only getting 10 lbs. out of each ton worked, they could now obtain from 30 to 35 lbs. It would be a question for gas engineers to consider how far they should adopt some similar arrangement, so that after the gas had been entirely taken out of the coal, and the coke left, it might be utilized by passing steam through it, so as to get a larger proportion of nitrogen in the form of ammonia, and in this way obtain what was desired by Mr. Chester, and produce in the works themselves all the substances that were required for purification. Mr. Chester also alluded to the fact that the sulphur compound factors had not as yet been attacked sufficiently; and with this he (Dr. Macadam) quite agreed. They were working on substances which were not present in large quantities; and the process he had suggested had not succeeded in doing the work efficiently without a certain amount of destruction of the illuminating power. This was a department to which both chemists and engineers must devote their attention. The only other point he wished to mention was with regard to the proportion of sulphur in coal. The author had alluded to the average of 14 lbs. obtainable by him in the products distilled from coal; and this might be admitted to be a reasonable amount, as it came to about 0·62 lb. per ton of material. Occasionally, however, there was a higher proportion. In certain inferior coals and shales which were now sometimes used in making gas, there was a much larger quantity; and in such cases probably the process referred to would be still more successful.

Mr. A. Edwards (Taunton) asked if Mr. Chester considered the oxide as spent when it had 39·1 or 40 per cent. of sulphur in it; because it seemed to him that he was selling it when it did most work. According to his experience, he might have had three changes more out of this oxide, assuming it to be of the usual quality. But there was possibly some reason why this oxide was sold with so low a percentage of sulphur in it. With regard to artificial oxides, it was, he believed, the fact that they were no longer worth using when there was 40 or 50 per cent. of sulphur in them. If he was right in this assumption, it made a great difference in the final result as compared with that stated in the paper.

Mr. J. Chew (Blackpool) said that he had been a sulphate maker for about twenty years; but the work took a considerable amount of the manager's time if it was carried on in a satisfactory manner. The pith of the paper seemed to be that gas managers were to be not only sulphate makers, but vitriol makers also. It might do very well for works in which from 100,000 to 150,000 tons of coal a year were carbonized to have plant set up for the manufacture of sulphuric acid, which might be afterwards used in the production of sulphate of ammonia; but many of the gentlemen present represented works which used considerably less than half 100,000 tons a year. In the first place, it would cost about £400 or £500 for a Claus kiln; then they would have to invest in sulphur plant, and to provide a skilful man to superintend. It might pay in very large works to realize more from the sulphur extracted from the gas; and he had frequently wondered why people had never set about doing it in the Metropolis, Manchester, and Liverpool, for he believed there was money to be made by it. He doubted very much, however, if it would pay in smaller towns. Certainly no works carbonizing less than 20,000 tons a year could, in his opinion, afford to enter upon such operations, considering the amount of outlay in the first place, and then the skill that would have to be applied, either by the manager himself or by some other competent man, for the production of the various chemical substances in question. It would, he thought, be much better for the manager to look after his own legitimate business. He (Mr. Chew) had used some artificial oxide; and it was just possible, if he produced his own in the way suggested, he might not be so successful as other people were. One or two gentlemen present had taken up this process. The President, he believed, manufactured his own sulphuric acid; and perhaps he would tell the meeting whether or not it was profitable. As far as his (Mr. Chew's) experience went, the manufacture of sulphate of ammonia was surrounded with great difficulties.

Professor Foster said he thought there were one or two points which some gentlemen did not quite understand. He agreed very much with what Dr. Macadam had put before the meeting, although, curiously enough, a few months ago they happened to be in the position of holding briefs on opposite sides in a case. He did not quite see his way to the application of the principles which he himself had for a long time advocated for getting more ammonia out of coal by the ordinary process of gas manufacture. In trying to work out this idea many years ago, it led to some very curious results. Eight years ago, in the Journal of Gas Lighting, he said the question of ammonia production in the manufacture of coal gas was one that was identical with the question then agitating the minds of gas managers—viz., high heats *versus* low heats. The apostle of high heats was a well-known gas engineer in the West of England, who had expressed his views publicly on the matter; and a small contribution, published by the Institution of Civil Engineers, took up a definite view not altogether favourable to himself. He had no public knowledge of what had been done; but it had filtered through one or two channels, and he believed he was strictly correct in stating, that the Corporation of Birmingham had had a very lengthened inquiry undertaken by well-known chemists—the question being why the quantity of ammonia in the Birmingham Gas-Works had been decreasing of late years. They could fill in the picture for themselves; but this really was the key to the question. If they used low heats in distillation in the ordinary way, they seemed to break up the ammonia, as was clearly demonstrated by his own experiments, undertaken by Mr. Livesey's permission. Another point raised at the same time was as to the possibility of getting more ammonia by the process of destructive distillation. Mr. Ludwig Mond had, within the last two years, published a statement in which he said he was now carbonizing coal, and from every 100 tons was getting 4 tons of ammonium sulphate. To do this he naturally used a larger quantity

of coal (about 25 per cent. more); but the cost of the stuff he employed was not greater—he did say it was even less—than the value of the increased ammonia which he obtained by the method. This was a corollary arising from his first work. The real question was how far gas-works could turn to useful purpose some of the information which had been acquired within the last ten years; and it seemed to him that the only way was to convert the coke into gaseous fuel, to scrub the gas, and to recover the sulphur and ammonia in it. Whether this could be done at a profit or at a loss, he did not know; that was a point for gas managers so settle. But it appeared to him that the only reasonable prospect of utilizing the nitrogen in the coal was in this way—in other words, to make water gas, and use it for carbonizing purposes, or as gaseous fuel. There were many difficulties in connection with the question; but if Messrs. Brunner, Mond, and Co. could do it, and pay the enormous dividends they were declaring, he thought there was a good deal to recommend the idea. Mr. Chester's figures fairly agreed with his own with reference to coal generally. He took about 2½ per cent. as the quantity of impurities by volume; whereas Mr. Chester gave it as 1 per cent. of sulphuretted hydrogen, and 1½ per cent. of carbonic acid. Therefore they were fairly average figures. With reference to the observations of Dr. Macadam about the shale gases, since they had had the pleasure of meeting in Edinburgh on the occasion he had mentioned, he had studied these gases. One fact which was most interesting to the gas industry was as to the temperature in the retorts; and he must say, as bearing on this point, that he had examined the gases from four works in which different coals were used, and where the retorts were operated somewhat differently, and yet there was only the merest trace of carbonic oxide in them. This was at variance with what had been stated. But these were the results of his experiments; and they threw some side-light on the question as to what was the temperature required in the retort in order to avoid carbonic oxide, and produce large quantities of carbonic acid. If this question were investigated, he believed it would be found that the temperature was much lower in the retort proper, though not in the shale, than they had hitherto been in the habit of supposing.

Mr. C. S. Ellery (Bath) remarked that the author must have taken a great deal of trouble in preparing this paper, in which there were one or two points of special interest. In the schedule he set down as eleven the number of times of using the oxide; and the percentage of sulphur in the spent material (bog ore) he gave as 39·1, which worked out to 3·5 per cent. per charge. He did not know if any special circumstances attended this working; but some of those present would be a little disappointed if each change of purifiers resulted in introducing only 3·5 per cent. of sulphur into the material. He rather fancied 9 per cent. would be nearer the mark, when the oxide was most active. Six changes to produce something more than 50 per cent. of sulphur, he should look upon as fair, ordinary work; and eleven to produce 39 per cent., struck him as peculiar. The labour per ton worked out to 1s. 3½d. for each change of boxes. Taking a box as containing 40 tons, this was something like 0·8d per ton—an expensive business, multiplying it by eleven changes. Another question was as to the value of the spent material. He had had very little experience with artificial oxide; so he should like to know if Mr. Chester found that the expense of it was less to buyers than was bog ore that was exhausted. It was certainly, as he gathered, a mixture very different in composition from bog ore; and he should be glad to know whether it was as good on the market, and what prices it fetched relatively to bog ore at any given date. Another question was whether using a material in which there must probably be some free acid would not have an effect on the boxes in which it was used. His experience confirmed the opinion expressed by Professor Foster, that the quantity of ammonia produced depended largely on the heat at which the coal was carbonized. He had lately been making some experiments, because the returns seemed to fluctuate; and he was quite satisfied that the temperature of carbonization made a very material difference, not only in the production of tar, but also of ammoniacal liquor per ton of coal. Whether or not it paid to use lower heats in order to get more liquor, was another question. He preferred doing without the liquor and getting gas; but it might be possible to have some method of producing an increased quantity of gas, and also of securing the ammonia they would like to have to sell.

Mr. W. A. Valon, after congratulating Mr. Chester on his excellent paper, said he was watching the Claus process with great interest, and should be glad to get more particulars with respect to it. With regard to making sulphuric acid from the products of coal distillation, the works must be in a suitable position and of a certain size in order to justify it. He noticed that Mr. Chester took a ton of bog ore and a ton of artificial oxide, and purified 620,000 cubic feet of gas by the ore, and 2,000,000 cubic feet by the oxide; but the ton of ore took up only 39 per cent., and the oxide only 42 per cent. Therefore there was a difference of only 3 per cent. in the two cases. Lower down he saw that the weight of sulphur taken up by the ore was 18¾ cwt.; and by the oxide, 32¾ cwt. These figures did not seem to agree; and he thought there must be a mistake.

Mr. S. W. Durkin (Southampton) remarked that the work done by the artificial oxide was certainly rather low; but he should like to know what was the percentage of iron in the bog ore and in the oxide, which he did not think was stated. He presumed the amount of work done would depend somewhat on the quantity of ferric oxide contained in either the ore or in the artificial oxide.

The President said that in Carlisle they went a long way in the direction advocated by Mr. Chester. Although Carlisle was a town where about 20,000 tons of coal were carbonized per annum, they managed to make their own sulphuric acid, using it in the manufacture of sulphate of ammonia; and they found it paid. The cost of acid varied so much in different districts that no one could say that, because Mr. Chester or someone else found it pay to make sulphuric acid, he would be able to do the same. In the Carlisle district they were a considerable distance from any place where the liquor could be utilized, or whence they could draw the acid. He had lately heard of an acid contract being made near Glasgow at a little more than 23s. per ton; and if he could buy it at this price, it would very materially affect his conclusion as to whether or not he should make it. As a matter of fact, he would have to pay £2; and he should think it cheap at the price. It was this that led him some years ago to consider the desirability of extracting the sulphur from the oxide, and converting it into acid; and they had done this now for some years. The cost, if he remembered rightly, was about 22s. or 23s. per ton. The process was carried on without causing any nuisance whatever. The sulphate works were at a station about half a mile from the gas-works. Mr. Chester's experience in the manufacture of artificial oxide was very instructive. They were told that it cost about 16s. a ton. In Carlisle they would have to send a long distance for bog ore; and he should not expect to get it for less than £2 per ton. If he could, as Mr. Chester did, manufacture artificial oxide at 16s. per ton, he ought to have done it long ago. The benefit of a paper like the one just read was that it stimulated one's thoughts in matters of this kind, to see whether methods of working could not be improved. He acknowledged that it did not always pay to go into matters of this sort; but every case must be decided on its own merits.

Mr. Chester, in reply, thanked Dr. Macadam for the flattering way in which he had spoken of the paper. He quite agreed with that gentleman's remarks as to the parallel to be drawn between artificial oxide and bone ash, which, though it contained only a small percentage of decolorizing material in proportion to the earthy matter, was more efficient than a purer article. This was particularly the case with the artificial oxide; and in dealing with this point, he might at the same time notice that raised by Mr. Durkin as to the percentage of iron contained in the oxide and in bog ore. He had always felt that the percentage of iron had practically no bearing on the efficiency with which the oxide acted. One might have an oxide containing 90 per cent. of iron, and yet not be worth anything in the purifier; and another containing an exceedingly small percentage, which was most efficient. The iron he put into the artificial oxide did not exceed more than about 70 per cent. of the total—viz., 1 cwt. to a ton of oxide containing 35 per cent. of moisture. But although the quantity of iron was small, the whole of it was in a condition for dealing with the impurities in the gas; and he took it that it was very similar to the instance cited with regard to bone ash. There was in the coal a

large percentage of nitrogen, which somehow they were not able to get into the gas. They only took out something like one-fifth of the known quantity of nitrogen; and, as Professor Foster had pointed out, it was possible, and had been done on an experimental scale, to have very much larger percentages of ammonia then were produced in the ordinary way. He himself had obtained as much as 60 lbs. of sulphate from a ton of coal, by distilling it with steam; while usually they would not get more than 28 or 29 lbs. If they could double the quantity of ammonia, the cost of production would be very materially reduced. All that was wanted was for somebody to show how it could be done. Mr. Edwards had commented on the low percentage of sulphur in the oxides of iron when they were considered to be spent; and he had asked if at the point of 40 per cent. it might be taken as a proper charging of the oxide. In his own experience, he found that 40 per cent. was the point to which the gas maker could most profitably load his spent oxide with sulphur. When the oxide was put into the purifier, it began—at all events in the case of the artificial oxides, but not so much in that of the natural—to take up 7, 8, or 9 per cent. of sulphur in the first charge; and then it was gradually reduced until it reached but 40 per cent., and the addition of sulphur each time of fouling was brought down to a small fraction. In the case of bog ore, as a rule, in the first, second, or third time of putting in, there was very little addition. Then it came into a more active condition; and ultimately it attained the maximum, and then began to go down again. It was only by the time it reached 40 per cent. that it arrived at the point when the cost for labour was far in excess of the amount of ammonia returned from putting in the additional sulphur. With regard to the size of works where it was desirable that these things should be manufactured, he should say that the process could be profitably conducted where the consumption of coal was 20,000 tons per annum. At the same time, if the town had a number of chemical manufactories immediately surrounding it, he was of opinion that the vitriol ought to be bought, instead of going to the trouble of making it. Most towns, however, were situated some distance from vitriol manufactories; and the owners of the gas-works had to pay large sums for the carriage of an article which could be produced without nuisance to much greater advantage on their own establishments. Professor Foster had dealt with the question of the effect of high and low heats on the yield of ammonia. This was an exceedingly interesting subject, but one into which he could not go then. Mr. Ellery had called attention to the quantity of sulphur put into the two oxides as being in the one case 42 and in the other 39 per cent.; and he thought this was, on the whole, a very low average. Each sample, at a certain period of its operation, took up as much as 8 or 9 per cent. from one or two charges. But as soon as it touched the maximum, it began to go down again; and the average worked out as was recorded in the paper. The figures were derived from actual facts; the two samples of oxide being carefully observed from the time they were brought into the works until they were sent out to be converted into sulphuric acid. The figures might not seem to be consistent with one another, as Mr. Valon had pointed out; but they were nevertheless actual records of what took place in connection with the two samples in question. The fact that in the one case the oxide purified 2,000,000 cubic feet of gas, and the sulphur was 42 per cent., while in the other it purified 620,000 cubic feet of gas and had 39 per cent. of sulphur, was, he thought, explained by the quantity of moisture originally contained in the two oxides, which was respectively 56 and 36 per cent. When sold, the ton of bog ore only weighed 18¾ cwt., as against 32¾ cwt. in the case of the spent artificial oxide. With regard to the question of free acid raised by Mr. Ellery, this was a matter which was entirely within control. It was quite possible to make an oxide containing a large quantity of free acid, and also one containing absolutely none. The lime was put into the mixture for the purpose of oxidizing the iron and neutralizing the acid; and it was only a matter of proportion to be perfectly certain of having a material that was alkaline. He made material quite alkaline by putting in rather an excess of lime than otherwise. The quantity of ammonia which could be obtained from gas fluctuated very considerably. He had noticed not only that it varied at the temperature at which the coal was distilled, but also largely with the coal itself; different coals yielding very different amounts, though they were distilled under similar conditions.

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The proceedings on the second day of the meeting then closed. The following morning, the papers of Mr. Charles Nickson, Mr. J. M'Gilchrist, and Mr. T. N. Ritson, Assoc. M. Inst. C.E.—on "Gas Workers' Strikes, with Suggestions for their Prevention," on "Coal Storeage," and on "The Disposal of Sulphate of Ammonia Locally"—were disposed of; and this brought the technical business to a close. These papers, with the discussions thereon, will be given next week.

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**Fire-Brick Manufacture in Russia.**—In the vicinity of Adjikent, in the government of Elizavetopol, a kind of refractory clay has been discovered of the quality required for preparing fire-bricks. Mr. Levin, a Swede, has availed himself of the discovery, and has established works at Baku for manufacturing fire-bricks. The output of these works amounted last year to about 450,000 bricks. It is thought that this industry, which it is intended to extend, may eventually oust from the local markets the fire-bricks now coming from Glasgow.

**The Action of Oils on Metals.**—A series of tests, lasting some twelve months, on the action of various oils on metals in contact with them, recently carried out in America, gave the following results: In the case of iron, seal oil acted the least on it, and tallow the most. Bronze was not attacked at all by colza oil, and but very slightly by olive oil; it was, on the other hand, vigorously eroded by linseed oil. In the case of lead, the most deleterious lubricant was whale oil; the best, olive oil. Whale, lard, and sperm oils were about equally erosive. Zinc seemed to be but little attacked by mineral lubricant oils; the best oil was lard, and the worst sperm. Copper was not attacked by any of the mineral oils; sperm oil had the least, and tallow the most action on it. Generally speaking, mineral oil attacked the metals under test the least; and sperm oil attacked them the most. In conducting the experiments, the metals were first thoroughly cleaned in ether, and then dried. They were next carefully weighed and placed in closed vessels filled with oil, which were kept for a year at a uniform temperature in summer of 80° Fahr., and in winter of about 50° Fahr.

**Municipal and County Engineers' Association.**—The annual meeting of the Incorporated Association of Municipal and County Engineers is to be held in the lecture theatre of the Institution of Civil Engineers on Thursday and Friday next. From the detailed programme issued by the Secretary (Mr. Thomas Cole, Assoc. M. Inst. C.E.), there will, it appears, be plenty to engage the attention of the members. After the routine business on Thursday at noon, the President (Mr. T. De Courcy Meade) will read his address; and the afternoon will be devoted to the reading and discussion of four papers, none of which is of particular interest to JOURNAL readers. The annual dinner takes place that evening at the Holborn Restaurant. On Friday, business begins at 11 o'clock, when Mr. W. H. Preece, F.R.S., will deliver an address "On the Relative Merit and Cost of Gas and Electricity for Lighting Purposes;" and this will be followed by a paper from Professor H. Robinson, entitled "Electric Lighting by Municipal Authorities." Several visits of inspection to various works will occupy the attention of the members in the afternoon; and the whole of Saturday will be similarly employed. Among other places to be visited that day will be the works of the Electric Supply Corporation at Deptford—working on the Ferranti system. It is also proposed to go to the Metropolitan Sewage Outfall Works at Crossness.

**Society of Arts.**—The Albert Medal of this Society for the present year has been awarded by the Council, with the approval and sanction of the President, the Prince of Wales, to Sir F. Abel, K.C.B., "in recognition of the manner in which he has promoted several important classes of the arts and manufactures by the application of chemical sciences, and especially by his researches in the manufacture of iron and of steel, and also in ackowledgment of the great services he has rendered to the State in the provision of improved war material and as Chemist to the War Department." The *conversazione* of the Society was held last Wednesday at the South Kensington Museum. The visitors, who numbered about 2000, were received by the Chairman of the Council (Sir R. E. Webster, Q.C., M.P.), who was attended by the Secretary (Sir H. Trueman Wood). The band of the Grenadier Guards played a selection of music in the North Court; that of the Scots Guards being in the Quadrangle. The evening was delightfully fine; and consequently the facility afforded by the latter locality for a pleasant open-air promenade was much appreciated by the visitors. The special feature of the occasion was a concert of old English music—given in the Lecture Theatre, under the direction Mr. A. Dolmetsch—performed upon the now obsolete instruments for which the compositions were originally written, and some of which, we believe, were used in one of the series of Cantor Lectures given before the Society in the past session.

# ESSAYS, COMMENTARIES, AND REVIEWS.

## GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 1267.)

THE anticipated reduction in the Bank rate was made on Thursday; and the 4 per cent. rate, which had lasted a fortnight, was lowered to 3 per cent. The strength of the Money Market is such that there is reasonable probability for expecting continued ease. The glorious weather, too, of the past week ought to be worth a lot of money; and good harvest prospects (which, if realized, mean so much less gold going out of the country) are looking up splendidly. But, in spite of all this, the persistent dulness of the Stock Exchange appears quite ineradicable. Naturally Argentine and Portuguese affairs exercise a depressing effect; and rumours will still fly through the air as to financial difficulties looming ahead of some big people. Poor John Bull is getting thoroughly unnerved; and he thinks the best thing he can do with his money is to put it into his pocket and sit upon it. Consequently, business is as quiet as it well can be; but no business is better than bad business. Even in the Gas Market, which is not so susceptible of changes in the financial barometer as are many other markets, business has not been up to the average, and prices are not uniformly better. Gaslight "A" has shown fair activity. The quotation was lowered 1 on Tuesday; but the transactions subsequently recorded did not indicate any tendency to weakness. In the debenture and preference issues, things were better; some cheap money probably going in that direction for investment. The figures realized showed good average business. South Metropolitans continue remarkably quiet; a couple of transactions in the "B" being all that was done. One transaction sufficed for Commercials. What business is being effected in them is almost all in the new allotments. Suburbans and Provincials have made a move at last, and in the direction of improvement. Brentford old is 3 better; and the new, 1¼. Alliance and Dublin has risen ¼. Among the Foreign Companies, business has been very quiet; but the tendency is good. Imperial Continental and Continental Union are firm and unchanged; while European part-paid is ½ higher. The Indian division does not present any feature; but among the South Americans, Buenos Ayres has recovered ¼. The Water Companies have been very quiet for the most part, although more business than usual was done in New River. The quotation fell 1; and dealings were marked as low as 348. At the Mart, however, on Wednesday, several shares were sold, and realized as high as 370—a discrepancy which is not easily intelligible.

The daily operations were: Gas opened quietly on Monday; and, except for a few dealings in various Gaslight issues, very little was done, and nothing moved except Buenos Ayres, which rose ¼. Tuesday's business was again most in Gaslights; the "A" receding 1. Wednesday was still more inactive; but changes of quotation were for the better; Brentford, Alliance and Dublin, and European advancing as noted above. New River fell 1. There was a shade more activity on Thursday; and prices were well maintained. On Friday, business dwindled away to very small proportions; and on Saturday it was reduced to next to nothing. On neither day did quotations undergo any further change.

## ELECTRIC LIGHTING MEMORANDA.

**A Double-Lift Prophecy—The Capacity of a Town District for Gas and Electric Lighting—The Glasgow Dilemma.**

THE poet has informed us that "Hope springs eternal in the human breast;" and the statement has been accepted as approximately true of humanity in general. Hopefulness has never been exhibited more brilliantly, or on a larger scale, by any order of mankind than by such as have to do with the commercial development of electricity. This is a comforting phenomenon of an age that has had Pessimism dinned into it by the innumerable crowd of philosophers. Evidently we need not despair of civilization while so many of the cleverest men of the day assure us that there are good times coming; for, though the choicest benefits that the Future has in store are held to be reserved for electricians and their friends, yet the world is so linked together that no numerous section of the community can prosper exceedingly without others participating in their happiness. And we have the word of our electrical friends that even in the day of their triumph the poor gas people will not be wholly without comfort; for shall we not be graciously permitted to earn, in the kitchen and the factory, the living which we may no longer seek by lighting the street, the warehouse, and the home? Wherefore it is with something of a pang that we have perused a report of a lecture on the "Possibilities of Applied Science," delivered by a hard-hearted person named Oberlin Smith—striking combination!—before the Franklin Institute of America, in which an attempt is made to deprive us of even this poor consolation. True, the lecturer, whose subject readily lends itself to loose talking, admitted that "in the near future, at any rate for our cities, some systems of gas heating will displace coal and wood to a large extent; and this is the more likely from the fact that our streets and houses are already supplied with the necessary pipes, which may perhaps be gradually thrown out of use, as conveyors of illuminating gas, by the improvement and development of electric lighting." We are only to enjoy this respite for a brief season, however, for Mr. O. Smith vents the terrifying suggestion that "at some time in the future we shall depend upon the electric current brought into each building through a single wire, not only for our lighting and power, but for our heating and cooking also." This double-lift kind of prophecy, as it may be called, is very saddening. Why could not Mr. Smith settle the future on one basis at a time? However, we must treat this particular prophet as we do the others, and console ourselves with the present. If gas engineers do not raise the old chant of "Let us eat, drink, and be merry, for to-morrow we die," it is not for want of invitation from the electricians.

In discussing the subject of electric lighting mains, Mr. W. H. Preece has remarked, truly enough, that the chief difficulty the engineer has to contend with in laying out a central lighting station and the distributing system is to suit the probable demands of the district. "This is now generally guesswork;" it being almost impossible to estimate the probable load-factor. Gas supply has to be taken as the criterion of the demand for electric lighting; and the probability of obtaining customers for electricity has to be estimated from the character of the district. That being so, we may be permitted to point out an error which vitiates a good many electric lighting engineers' estimates. It has been customary to argue that the provision in a town district of a certain number of electric lamps means the displacement of an equal number of gas-burners; but this is not the case. Unless the gas-lamps in question are used in very large places of business, mansions, or high-class places of amusement, they will probably remain absolutely unaffected by the advent of an electric lighting system. It by no means follows that, because a gas company can derive a certain revenue from a particular locality, therefore an electric lighting company can do the same. This is a lesson that speculative electricians are just beginning to learn. In chemistry, one salt added to a solution may or may not drive out the one which was previously dissolved. It may precipitate it wholly or partially, or may itself pass into solution without exercising any appreciable effect upon the previous constituents of the fluid—packing itself away, so to speak, among the interstices left by the former. So it is with gas and electric lighting; only the trouble is that there is no ready means of ascertaining what in any particular case will be the probable result of superposing one system of lighting upon another.

The electrical press is making merry over the dilemma of the Corporation of Glasgow with regard to the carrying out of their authorized Electric Lighting Order. We are not disposed to follow this example; having a suspicion that the authorities of the "Second City of the Empire" will yet manage to give a good account of their stewardship in this matter. It is quite true that the Corporation Committee have sought advice from consultants whose views might have been predicted beforehand by any one conversant with their individual predilections, and naturally obtained such conflicting advice that they do not know what to follow. Our contemporary, the *Electrical Review* remarks upon this state of affairs that "the name of consulting engineer should alone be used by men who are perfectly independent of all trade influence, and therefore unbiassed." This is a very sound aphorism, of the copy-book heading order, and possessing only the defect of not helping one to know a true consultant when we see him. Sir W. Thomson is gibed at because, while recommending a low-tension system for the Glasgow Corporation installation, he encouraged the local Company at present supplying (without authorization) by a high-tension system, by stating his opinion that such a method is the best for large districts. But there is no real contradiction in the two expressions. If you can get within short range of your game, a 12-bore shot gun is as good as anything you can have to kill with; but if you must take pot-shots at a distance you want a rifle. The same sportsman can subscribe to both statements; and the same electrician can admit the respective advantages of different systems of lighting for compact and scattered consumption. It will be extremely interesting to see what the Glasgow Gas Committee will make out of the awkward conditions under which they must embark upon electric lighting, if they do the work at all. Their responsibility is not to be envied; and their only hope for avoiding a great risk is to exercise to the full their native caution, and not attempt to do too much at one time.

**The Estate of the Late Mr. Stephenson Clarke.**—The personal estate of the late Mr. Stephenson Clarke, whose death occurred on the 3rd of April last (as announced in the JOURNAL at the time), has been sworn at £943,619 gross, and £941,207 net value. The deceased gentleman was the senior partner in the firm of Messrs. Stephenson Clarke and Co., of St. Dunstan's Alley, and one of the chief proprietors of the Ruabon Coal Company. His will is dated Feb. 6, 1890; and there are several codicils—the last having been made on Jan. 10 of the present year. The executors are the testator's son Stephenson Robert, his two brothers-in-law, and his nephew. The business is divided into 32 shares, seven of which go to the above-named son, six to the testator's son Charles Bridger Orme, one to Mr. H. Pilley, and two to Mr. Hubert T. Bailey.

## MR. A. E. FLETCHER ON HOUSE-HEATING.

THERE is a passage in the last report of the Chief Inspector under the Alkali, &c., Works Act, which was mentioned in last week's JOURNAL, that deserves more attention than it is likely to receive unless special notice is taken of it by those who are most interested in the subject to which it refers. This is the statement volunteered by Mr. Alfred E. Fletcher with regard to his personal experience in the matter of house-warming. Mr. Fletcher observes that the open coal-fire, which is responsible for causing the smoke nuisance that so grievously oppresses London and other residential cities, may be most hopefully superseded by some "means for imparting a general warmth to the air of the house from a central source, so that the need for open fires shall become less pressing." And he goes on to assert that he himself has "lived in a house during five winters, in which time no bituminous coal was burnt, and no contribution was made to the smoke of London." Yet, says he, "the comfort experienced was greatly beyond that of my neighbours with their open fires and draughty rooms." Having aroused curiosity by this general declaration, Mr. Fletcher partially satisfies it by describing, without going into detail, how this desirable end was attained. He minimized and rendered open fires less necessary by having a stove placed in the basement of the house, so arranged that an ample supply of gently warmed air passed from it to permeate all the passages and apartments. "The air at its inlet should be first filtered by passing through a screen of cotton wool. This filtering the air admitted to a house is a simple matter, and adds much to cleanliness and comfort. In foggy weather in London, the outside of the filtering-sheet becomes black in a week from the smut and dust collected, which would otherwise have passed into the house. Moreover, it is the charring of this dust which causes the burnt smell in heated air; it is obvious that the air itself passing over a hot stove is not altered." This is Mr. Fletcher's advice for curing, or at least mitigating, the smoke nuisance; and we desire to pay it the respect of careful examination.

In the first place, it is clear that the interest of the gas industry in this communication of the Chief Inspector of Aërial Sanitation (to give Mr. Fletcher a title of our own devising, which we venture to consider more comprehensively significant than his cumbrous official designation) is immediate and pressing. It has been a commonplace of talk about the future of coal gas, that it must come more and more into favour as a fuel as the sense of personal responsibility in connection with the smoke evil becomes keener in town communities. Thus, while it has been admitted, even by the partisans of gas for all imaginable uses, that the so-called gas-fires of the present day leave much to be desired, their cleanliness has been generally confessed; and it has been vaguely hoped that their drawbacks might be overcome in the course of time. This hope still remains for us; but, in the meantime, it is with something of a shock that one perceives a high authority in aërial sanitation leaving the gas-fire or heating-stove entirely on one side and recommending warmed air distributed from the basement, as the average householders' remedy for the smoke evil.

It is useless to close one's eyes to facts, however; and it will not be lost time that is applied to the consideration of Mr. Fletcher's recommendation, even though it seems to require us to turn our back upon one of the conventionally accepted remedies for a condition of things that grows every day worse instead of better, notwithstanding all that has been said and done in and about the question of smoke abatement. For it is not to be denied that only its apparent hopelessness prevents the smoke question from filling the thoughts and occupying the energies of the English people. It is smoke that renders life in London and all other large towns a weariness and a worry, when it might otherwise be pleasant and healthful. Volumes have been written to arouse Londoners and the English people generally to an acute sense of what they suffer from the smoke nuisance; but, after all, care with regard to the subject has seemed as superfluous as the grief displayed by the "Walrus and the Carpenter" concerning the sandy condition of the seashore. Neither sand nor smoke has appeared amenable to ordinary means of removal; and so it has seemed idle to fret over its presence. Yet it is impossible to let the question rest for long together; and, so far as London is concerned, an acceptable solution is rendered more desirable and more urgent every day by the progress of the movement for concentrating population within the limits of the town, which is a notorious sign of the times. The recent Census shows that the London suburban population is not increasing at what has been regarded as the normal rate; but the substitution of lofty tenement residences in favourite neighbourhoods for single habitations goes on apace, and will be continued—for reasons which need not be expounded in detail here, but with which every London resident is familiar.

Unfortunately, London builders may erect handsome and commodious storeys of "flats," and modern ingenuity may spend itself in devising arrangements for reducing the material friction of town life; but, after all is done, the smoke, and its condensed form "the blacks," remain to dim the glitter and spoil the comfort of town life. Electric lighting companies aver that by their help the dirt of town houses may be reduced; but the promise is only a "catch," for places of public resort and private residences in the smoky area of Central London are seen to get just as dirty with the electric light as with gas. Nor can it be otherwise, while the air itself is charged so heavily with soot that the very clothes and portmanteaus of a Londoner are redolent of it when removed to any place where coal is not used for fuel. It matters little in the long run whether the dirt deposited from the smoky atmosphere is burnt by gas-flames and condensed into spots on the ceiling or spread uniformly over every surface. At the present moment, as a matter of fact, perhaps the very dirtiest of all the buildings devoted to purposes of public entertainment in London has been lit by electric arc lamps for years. We do not care to mention this establishment by name; but it is not a hundred miles from the Institution of Civil Engineers.

Now the worst of this prevailing condition of London air—and in speaking thus of London, we embrace all other large English cities and towns—is that even when a resident does not contribute to the universal smoke himself, he suffers just as much as if he did. This is one of the greatest hindrances to the popularity of gas-fires on the score of cleanliness. True, they do not make smoke. But neither do they keep it out; and in London a householder finds his rooms dirtied just as much in summer as in winter, by other people's smoke if not by his own. Here, it must be admitted, Mr. Fletcher scores heavily, with his arrangement for delivering warmed filtered air to a house from a central source. The central hot-air stove in the basement is much used in the United States; but this is mainly on account of convenience of management, and is a practical concession to the domestic servant difficulty. A man can attend to the stoves of several houses; and thus the trouble of heating is overcome without requiring the performance of "menial" offices. Unquestionably, when to this consideration is added that of ensuring a supply of clean as well as warm air, the central stove, which promises such advantages, rises in one's estimation.

It is often remarked that the average Englishman's attachment to the open coal-fire is such that he could never be persuaded to dispense with it in favour of a vastly more economical substitute; and that, taking it all round, the much-abused open fire is a very suitable and healthy warming agent for a humid, uncertain climate like that of the British Isles. But, in Central London at any rate, it is not so much a question of economy as a question of cleanliness and domestic comfort. Fondly as the Londoner may love his cheerful fire, and lightly as he may regard the accusation of adding thereby to the smoke pall that hangs over the town (and is never thought of until and unless it materializes in the shape of a fog), it is an interesting problem whether he does not on the whole like cleanliness more, and whether for the sake of this result he would not reconsider a question which the stale argument for economy alone would never induce him to open. It is one thing to send smoke out into the air, and another to have to breathe it and rub one's hands on it, when sent into one's own apartment by the door and windows, and even down the chimney. The poet who was attracted to a cottage by the sight of the "smoke that so peacefully curled" from the chimney-top, would have fled the scene if the action of the chimney had been reversed while he was sitting indoors. Yet this is the exact condition of residence in every considerable British town at this moment.

It would be a striking illustration of the tendency of history to repeat itself if modern architects were to revert to the old Roman principle of warming houses; but it is tolerably certain that something of the kind will have to be done if the movement for concentrating population in town areas, by the extension of the "flat" system, is to succeed in the long run. It is absurd to pretend that every occupant of the hundreds of rooms in a huge monumental residential building wants a fire and a smoky chimney all to himself. He would in most cases be thankful to be spared the trouble of the old-fashioned arrangement; and any architect who could guarantee a minimum temperature of 56° Fahr., with an ample supply of clean, filtered air, for all the apartments and corridors of a residential building, sent through the establishment at a pressure that would ensure all draughts being from within outward, instead of the other way, would do more to solve the problem of abolishing London smoke than any number of essayists and lecturers. There is no need for any new invention in connection with this work; but there is plenty of scope for unconventional ingenuity in the necessary arrangements. In the case of a large building, of course, mechanical means can be employed for compelling the air supply to take the desired directions. But this is not the case with small dwellings; and it is not quite clear how Mr. Fletcher could always depend on getting his warmed air to the places where it is required. It is quite possible to believe that when the interior temperature of an inhabited house is maintained at a comfortable minimum (such as we have indicated), the inmates would cease to look for fires. If a sufficiency of gently warmed air is poured into an entrance-hall, the bed-rooms and corridors never "strike chilly," as they do in periods of frost under other conditions of house-warming; and the reception-rooms are easily kept at a comfortable temperature. We have repeatedly urged the undesirability of the usual conditions of cold bed-rooms and passages to which the open-fire system of warming condemns the majority of English householders.

In conclusion, we desire to emphasize the truth that there is a very great deal of reason in Mr. Fletcher's suggestions for

the disestablishment of open coal-fires, especially when the combination of his favourite method of heating with the supply of interiors with filtered air is preserved. Houses so supplied will not be so liable to blackened ceilings from the gas-burners employed for lighting; and where a little extra or localized heat might be desired, a gas-fire would easily give what is needed, because to raise the temperature of a room (say) from 56° to 60° or 62° Fahr. is a very different thing from dealing with a mass of air, walls, furniture, &c., all at a few degrees only above freezing-point. Moreover, broken coke is the ideal fuel for a slow-combustion, air-warming stove. Whoever of our readers has occasion to build a house may be recommended to study this question thoroughly before committing himself to the conventional provision of separate grates and chimneys, with perhaps a hall-stove thrown in as an after-thought.

## HENRY COCKEY.

A LARGE number of our readers will learn with deep regret of the death of Mr. Henry Cockey, the Managing Director of the firm of Messrs. E. Cockey and Sons, Limited, gas engineers and contractors, of Frome, who passed away on Wednesday last, having attained the ripe age of 81 years. Probably no name is better known or more respected in gas circles in the South-West and South of England; for the deceased gentleman identified himself with the construction of gas-works in these districts at the time of their introduction nearly 60 years ago, and actively maintained this connection until comparatively recently. For more than 30 years he held the position of senior partner in his firm, which belonged entirely to the family until it was disposed of to the Limited Company now carrying it on. This was done about five years since, when increasing age and failing health rendered it imperative for him to seek some relief from active business life. Mr. Henry Cockey was son of Mr. Edward Cockey, who established the business of an ironfounder and agricultural engineer. At a very early age he became partner in the undertaking; his brother, Mr. Frank Cockey, who died about four years ago, being associated with him. Mr. Henry Cockey found it advisable, from the first, to direct his attention solely to the gas engineering department; and after the death of the father in 1862, the brothers carried on the business. He was a member of The Gas Institute, and a regular attendant at the meetings. The appointment of Manager to the local Gas Company was held by him for many years, and not entirely relinquished until about a year ago. His opinions on all topics connected with the gas industry were highly valued; and he was connected, either as lessee, consulting engineer, or one of the directors, with a considerable number of gas-works. He was a member of the Local Board, and entered actively into all parochial matters and charitable organizations in his district. The funeral took place yesterday afternoon, and was largely attended by local friends, employees of the firm, and a number of members of the South-West of England District Association of Gas Managers, of which the deceased gentleman was one of the founders and a Past-President.

# NOTES.

### Coal-Discharging Machinery.

Attention is being directed to coal-handling machinery of all kinds, in connection with the growth of opinion in favour of the storing of coal in greater quantities upon gas-works. The question of cranes and tipping trucks *versus* conveyors is exercising the minds of many engineers, whose choice of system is naturally swayed by considerations arising from peculiarities of site and location. Labour-saving machinery is specially desired by those who have to take large supplies of coal from ships, sometimes without the convenience of a jetty provided with steam or hydraulic hoisting plant. To deal with this state of things, Mr. G. Blumcke, the representative of the Westinghouse Machine Company for Germany and Austria, has adapted the small Westinghouse engine for discharging sailing colliers entering the sea-ports of North Germany. Hitherto these vessels have been discharged by gangs of 72 men in 24 hours, but with the hoisting engines, the coal is whipped out by 30 men in 12 hours. The hoisting plant is erected temporarily on board the vessels as they come into port, and discharges cargo just in the same way as by hand-whipping; the labour being thus reduced to filling the baskets. Here, however, is the obstacle to progress in the application of power to unloading colliers. There is no difficulty about the hoisting of the skips or baskets, which can be done by the ton as easily as by the hundredweight. Manual labour is still required to load the baskets, however; and while this is the case, the discharge of coal cargoes cannot be regarded as being a satisfactorily solved problem of the age.

### Mr. F. Siemens's New Regenerative Furnace.

It is stated that an extensive installation of Mr. F. Siemens's new regenerative retort furnaces is being put into the Halifax Gas-Works, where they will be tried against an equal number of recuperative furnaces of another pattern. The main principle of these new furnaces consists in returning a proportion of the products of combustion through the generator, in order that the carbonic acid may be converted again into carbonic oxide. Notwithstanding the fact that these furnaces are double acting, they are described as being much simpler and cheaper in construction than earlier patterns with the single recuperative effect. The difference in principle is represented by a single flue, which can at any time be stopped with a tile, if desired. The economical advantages of the new style of furnace are represented as being very remarkable—amounting to a saving of 50 per cent. of fuel, as compared with ordinary regenerating furnaces. Thus, if the regenerators at present in use at Halifax do their work with a consumption of 14 lbs. of coke per 100 lbs. of coal carbonized, the new ones are expected to take only 7 lbs. of the same sort of coke to do the same duty. If this expectation is justified in practice, Mr. Siemens's latest production in the way of regenerative furnaces will be very valuable to the gas industry. Experiments at the Milan Gas-Works—where coke is of high value—are reported to have fully borne out Mr. Siemens's claims in this respect. It may be remarked that the economy of the new furnaces has been abundantly proved in steel works; the consumption of fuel for reheating, &c., having been reduced by this means to less than a fourth of what was considered good practice a few years ago.

### The Hot Testing of Cement.

According to correspondence and statements that have appeared in the leading engineering journals, a radical change in the method of testing Portland cement is imminent, if it has not already established itself in the best practice. This is the testing of the material hot, as mentioned in a "Note" in the JOURNAL on March 31 last (p. 592). Expert opinion seems to be agreed as to the value of the method as a means of detecting lime—the most dangerous constituent of cement intended to be used for heavy work. Of course, until extensive series of data have been collected and analyzed, it will be impossible to say with precision wherein the results of the hot testing of cement differ from those of the methods hitherto practised; but enough has been established to show that the new test possesses many very strong recommendations. Mr. W. G. Margetts, writing from Burham, near Rochester, sums these up by stating that "not only do you arrive at the tensile results at a much earlier date, but the soundness of the cement is ascertained at the same time; and an imperfectly combined cement containing free lime is found out at once, instead of, as is too frequently the case, after it has been put into the work." With boiling water, test-blocks are brought in three days to the strength they would attain after seven days in the cold. Deval recommends a temperature of 180°; but Mr. Margetts says that boiling water, although undoubtedly a severe test of any cement, will not hurt it if the combination of material is perfect. Others, however, prefer the lower temperature. There is an admitted difficulty in properly maintaining the temperature, which would be exaggerated in unskilful or careless hands. The assistance of gas apparatus manufacturers is therefore invoked to put into the hands of civil engineers and cement manufacturers a hot cement-testing arrangement which can be safely used by a busy clerk of works. If this done, a strong impetus will be given to the new method of testing. The problem should not be difficult, as there are many varieties of thermostat for laboratory use.

### Briquette Fuels.

Efforts have been made of late to foster in London and other English towns the consumption of briquettes of fuel compounded of coke, breeze, and tar-works refuse. Though the trade seems to be growing, there is nothing like the demand for this class of fuel in any part of the United Kingdom that there is in many parts of the Continent, which is of course mainly due to the fact that such regions are less bountifully supplied with coal, which sets the standard of value for other kinds of fuel. Continental collieries produce vast quantities of briquettes made of their slack, sometimes gauged with pitch, but occasionally with clay. These latter are of small calorific value; but they are useful for many purposes, as they burn slowly and keep alight a long time. A proposal has been made to form iron ore dust into blocks with coke or slack, cemented by lime, to facilitate reduction in the blast furnace. The Eastern Railway of France makes briquettes from the dust of its coal and coke yards, and also from the fine dust cinders removed from the smoke boxes of its locomotives. Messrs. Dupuy's machinery is preferred in France in this manufacture, as requiring small motive power and economizing pitch. With these machines a cohesion of 65 to 70 per cent. is obtained with ground coal slack and 7 to 8 per cent. of pitch; while a cohesion of 83 per cent. is obtained with coke dust. Evidently more attention than has yet been directed to the subject in this country should be devoted to briquette fuel of various kinds.

**Coal in Kent.**—It is stated that the payable character of the coal discovered at the Channel Tunnel borings has been conclusively proved. The Channel Tunnel Company are reported to have concluded negotiations for a mining lease of all the property, consisting of several hundred acres, belonging to the Ecclesiastical Commissioners.

## COMMUNICATED ARTICLE.

### THE USE OF AIR IN PURIFYING GAS.

By Norton H. Humphrys, Assoc. M. Inst. C.E., F.C.S.

Those who have followed the literature of this interesting subject will remember that at the 1888 meeting of The Gas Institute, in the course of a paper read by Mr. W. A. Valon,* it was contended that air could not be used, even in so small a quantity as 2 per cent., at the inlet of the purifiers, without affecting the illuminating value of the gas to an important extent—such as 1 to 1½ candles. At the meeting held the following year, these experiments were again referred to; and several others were advanced as supporting them. It was also urged that oxygen supplied to the crude gas in a practically pure form was much more active than when supplied by means of air. It happened that the experience of the present writer did not agree with these conclusions; he having used air in the proportion of 1½ per cent. without appreciably lowering the illuminating power of the gas. Some particulars were given in the subsequent discussion; and he also suggested that, comparing a mixture of 0·5 per cent. of pure oxygen and 99·5 per cent. of crude gas, with one of 2·5 per cent. of air and 97·5 per cent. of crude gas, the only difference was that the latter contained 2 per cent. of nitrogen. And it was difficult to see how the presence of so small a proportion of nitrogen could affect the behaviour of the oxygen one way or the other. He therefore, while not disputing the accuracy of Mr. Valon's results and experiments, claimed that they could not be taken as of universal application, as it was possible, under some circumstances, to employ air without any appreciable detriment to the illuminating value of gas.

In the course of his reply, Mr. Valon did not hesitate to reflect very strongly upon the statements thus advanced. He suggested that they would be "a dangerous weapon in the hands of the public if allowed to go forth;" that the object of discussion was to elicit the truth, and not to hide it; that the use of air as suggested was either an act of dishonesty or a waste of money; and that, as a matter of fact, it was impossible the statements could be correct. Notwithstanding Mr. Valon's apprehensions for the credit of the Institute and the safety of gas undertakings, the statements that were so objectionable to him were published; and so far they do not appear to have injured one or the other. More than that, the thing that was so vigorously denounced as impossible has been repeatedly substantiated by various gas engineers, and especially by Mr. Charles Hunt in his elaborate researches on the subject, as contributed to the Institution of Gas Engineers at their recent meeting (*ante*, p. 1004). Now that the matter has been not only discussed, but practised to a sufficient extent to place it beyond question, there are a few points in connection with it to which attention may be directed.

No one has disputed the fact that if ordinary coal gas is taken and mixed with varying proportions of air, a noticeable depreciation is produced. This has been tried by several different observers; and the numerous published tables agree so nearly as to enable a general table, showing the diminution caused by each unit per cent. of air, to be easily compiled. Assuming crude (instead of pure gas) to be taken, there appears no reason why such a table should not still hold good. In these cases, the air and gas are simply mixed in a holder; but when air is admitted as an aid in purification, the mixture passes through the purifiers, and various chemical changes, resulting in the removal of the oxygen, sulphuretted hydrogen, and perhaps carbonic acid, obtain. If all the oxygen is not absorbed, the small proportion that remains is considered to be beneficial rather than otherwise; so that attention may be confined to the effect of the residual nitrogen on the illuminating power of the gas.

It may here be remarked that the plan of simply turning as much air into the gas as it will stand without showing loss of quality, while offering an easy way of applying this system, does not commend itself as the most efficient. No competent gas engineer will contend that any advantage can follow the use of an exorbitant quantity of air. All that is needed is sufficient to combine with the sulphuretted hydrogen present, together with a moderate excess as practice may indicate. This cannot be arrived at unless there is a fairly accurate knowledge of the quantity of sulphuretted hydrogen to be dealt with; and this can only be obtained by regular and periodical analysis of the crude gas, together with a knowledge of the properties of the various kinds of coal used, in this respect. In all that he has written and said on this subject, the writer has had in view the use of a proper proportion of air, admitted through a meter, in such quantity as an actual knowledge of the work to be done may indicate. His experience has been confined to the removal of sulphuretted hydrogen, as the coals with which he has to deal yield only a low proportion of carbonic acid and sulphur compounds. Lime being costly, and the used material valueless, it is cheaper to employ a little cannel to compensate for the former, and as the latter rarely rise above 10 grains per 100 cubic feet at the inlet of the purifiers, they do not here call for further attention.

In dealing with the illuminating power of the gas we supply, it is necessary to consider something further than the legal 5 cubic feet test. Not only must the gas pass this satisfactorily, but it must also pass the ordeal of the fishtails, batswings, atmospheric, and other burners used by the consumers. Although to a certain extent the examiner and the consumer run together, this is not necessarily so, and the engineer who is wise in his day and generation will do well, in these times of oil and electricity, to attend to what the consumers choose to say on this point. If complaints about the quality of the gas are frequent, he will cast about for a means of satisfying the public, rather than seek to shelter himself behind the official returns. A moderate increase of illuminating value is frequently a wise investment. If the use of air is attended with the disadvantages claimed by Mr. Valon, it may safely be assumed that the consumers would find them out, even if the photometer did not; and that complaints and dissatisfaction would prevail in the districts where air is used. Although the writer has had personal knowledge of the introduction of the air system in some ten or twelve districts, in no one case has it caused complaints from consumers. Nor is there any instance of it bringing about anything in the way of fines for deficient illuminating power.

The paper on "Purification" read at the recent meeting of the Institution of Gas Engineers by Mr. Charles Hunt, already referred to, goes a long way towards explaining the successful use of air. At the worst, Mr. Hunt shows that a unit per cent. of nitrogen means a loss of less than 0·25 candle power, or a very small percentage; and it accounts for the higher results previously returned by the custom of adjusting the consumption to 5 cubic feet per hour, which happens to be less favourable to the diluted gas. But the table of experiments on a practical scale shows even more favourable results; and points strongly to the existence of certain compensating influences attendant upon the use of air. In all but one of the experiments quoted, the loss of value in terms of each unit per cent. of air introduced was less than 0·5 per cent. In one, which included the use of 3·44 per cent. of air, the depreciating effect was practically *nil*. The existence or nature of these compensating causes has been neither positively proved nor disproved. We only know of them by the observed effect. The slight rise in temperature observed in the purifier has been referred to as productive of benefit, by preventing or hindering the absorption of illuminating hydrocarbons by the oxide. It will invariably be observed that the foul material, when air has been used, is much less "gasey" than where the reverse is the case, although it may have passed ten times as much gas. In dealing with this subject, it has been the rule to assume that the whole of the nitrogen remains in an inert state in the purified gas. But, this has never been proved. The researches of some German chemists, recently published, show at least the possibility of an absorption of nitrogen in the oxide purifier. So it may be that a part of the so-called compensating influence is due to the fact that the actual percentage of nitrogen remaining in the crude gas is in reality lower than would be supposed.

The ordinary processes of purification do not take cognizance of the quantity of impurity to be removed. An *excess* of liquor, oxide, lime, &c., is used, and nobody knows much about what the extent of that excess may be. From a chemist's point of view, the use of air or oxygen is an interesting advance on this way of working. An endeavour is made to introduce these reagents in the exact proportion required, just as lime is applied for the softening of water. And it is obvious that, when any gaseous agent is used, this procedure must be followed, unless it happens that the agent is both cheap and not harmful to the gas. The real *crux* of the process will therefore depend upon the proportion of sulphuretted hydrogen to be removed. At the inlet of the purifiers, after ample washing and scrubbing, this may be as low as 400 grains per 100 cubic feet. But introduce another kind of coal, and it may go up to 1000 grains or more. The writer has made a large number of experiments on this point. A diagram showing the proportion of sulphuretted hydrogen present in the gas at the inlet of the purifiers throughout a period of twelve months' working was included in a paper read at the 1889 meeting of The Gas Institute.* This and subsequent researches show that, with the same kinds of coal and methods of working, the proportion of this impurity present at this stage of the purification is fairly even. It rises or falls according to the quantity of gas made, in a regular ratio; and therefore, with the aid of the diagram above mentioned, the quantity present at any particular period can very readily be estimated.

The proportion of sulphuretted hydrogen in the gas, and the bulk of gas passed through the purifiers per hour, determine the quantity of work to be done in a given time. A purifier 20 feet square, containing oxide equivalent to 2½ feet thickness, will hold 1000 cubic feet of material. If we find that gas containing 600 grains of sulphuretted hydrogen per 100 cubic feet passed through at the rate of 20,000 cubic feet per hour is completely purified, we have a removal of 120,000 grains per hour, equal to 120 grains per cubic foot of oxide. This factor of "grains per cubic foot of material per hour" will be directly influenced either by the quantity of gas passed, or by the proportion of impurity present in it. Gas engineers are accustomed to base their data on one of these only—the quantity of gas;

* See JOURNAL, Vol. LI., p. 1174.

* See JOURNAL, Vol. LIV., p. 50.

neglecting the other, though it is of equal importance. And this neglect is responsible for a great deal of the confusion which arises when the purifying statistics at different gas-works are compared one with the other. The engineer who happens to have the lower proportion of impurities to deal with, receives credit for the supposed very efficient action of his apparatus; while, on the other hand, those who are troubled with high proportions of impurities are led to conceive unfavourable opinions respecting the particular forms of apparatus that they happen to use.

## TECHNICAL RECORD.

### WESTERN (U.S.A.) GAS ASSOCIATION.

The Fourteenth Annual Meeting of this Association was held at Louisville (Ky.), on the 20th ult. and two following days. Mr. Frederick Egner, Engineer of the Laclede Gas Company, St. Louis, was the President.

In the course of his Inaugural Address, the President asked, referring to the objects of the Association—which aimed at reducing the cost of gas to the lowest possible point—how far it might be considered that they had advanced towards that goal, and what ground yet remained to be covered. Much had been done; but the greatest obstructions, not only to cheap gas, but also to the best interests of gas shareholders, yet remained to be dealt with. In directing attention to these, he wished that not only those present, but all who were interested in gas, could hear and seriously reflect upon his words. If all had not succeeded in bringing the cost of gas down to the lowest feasible point—subject only to reductions in the cost of material or wages, or to improvements as yet undiscovered—they knew what to do, and were doing it as fast as circumstances would permit.

In a country so extensive as theirs, the greatest diversity of local conditions existed; but all were alike affected by two great obstacles—viz., over-capitalization and the professional opposition gas company. Some excuse might be offered for the first, as many useful and important enterprises would never be started but for those who were willing to incur some risk in extending the necessary financial support; but it was a standing invitation to the professional opposition company, which in the end proved a constant threat and danger to the shareholders, a scourge to the employees, and also a burden to the gas consumers. The phenomenal development of the United States during the past 60 years not only made over-capitalization possible and extremely profitable, but also enabled speculators to make money out of largely watered stocks and bonds. The cities all developed so rapidly that the business would soon catch up even a heavily loaded capital. The conditions that rendered this sort of thing safe in the past, however, had now met with a serious check in the first genuine competitor that gas had encountered—the electric light. Although electricity could not be produced, distributed, and sold as cheaply as good illuminating gas, to yield the same return on the money actually invested, it could be sold in competition with gas made at works that were capitalized very much above their real value. Most of the money made by electric lighting was really earned by the sale of plant, concessions, &c.; and unless better prices were obtained than are now usual, there was really no return for honest investors in the *bonâ fide* supply of the light. Contracts had frequently been taken at less than cost price, simply for the purpose of intimidating the gas companies into the purchase of the outfit at a price much greater than the actual first cost. But nothing need be feared from the electric light, if the gas was good and cheap; and the sum of the matter was that gas must be sold at as low a price as a fair return on the capital actually invested would warrant. Really cheap gas was not possible until over-capitalization was made impracticable; and this could be best brought about by legislation making the professional opposition company impossible. Give the capitalist a feeling of security, and he would be glad to accept a low rate of interest. As an example of unwise legislation, unchecked capitalization, and so-called competition, he instanced New York, where £100,000 or more was paid annually for gas, over and above the cost at which it might be sold to pay a fair 6 per cent. dividend. It might be suggested that the prohibition of opposition gas companies by law would enable the existing undertakings to appropriate large profits; but to meet this view he thought the grant of an exclusive franchise could be attended with a limitation of the dividend to be paid. As to local authorities making their own gas, he considered the functions of the Government should be confined to their proper sphere, which did not include going into manufacturing business of any kind. However great the provocation, the result of letting in a competing company was always a loss to shareholders and consumers alike; and therefore he strongly advocated measures similar to the Massachusetts Gas Commission, or better ones if they could be devised. There was no State in the Union in which the gas companies would not find it cheaper to maintain a Gas Commission than to submit to the losses due to the two causes above indicated. These matters must sooner or later be squarely met and settled; and he believed the time to do this was at hand. It had been urged that gas companies should not take part in any agitation to this end; but he held that it was their duty to do so, and recommended the formation of Committees in each State to bring the matter before the respective Governors.

Turning to matters relating to his own practical experience, the President recounted how the adoption of oxide in place of lime in his purifiers had led to considerable trouble with the meters. This was eventually traced to the escape of ammonia (formerly absorbed by the lime), from the scrubbers. Referring to the system of inclined retorts that he had been trying—the Coze system with Arndt furnaces—he said that he had preferred to take the gas off from the upper instead of from the lower end of the retorts, as recommended by the patentee. This had led to a great deal of trouble from pitch in the hydraulic. The difficulties of working were so great that the men would not stop, the retorts accumulated carbon rapidly, and the expense of working was therefore excessive. Even a reduction of working temperature to a bare red heat did not help matters. If he had kept to the original plan, he believed they would have been more successful; and he thought that the system would eventually come into general use. He had lately erected an oil-gas works on the Pintsch system, and was supplying railway carriages with the compressed gas. From Pennsylvania crude oil, he obtained 70½ cubic feet of 45-candle gas per United States standard gallon (231 c. in.), which lost 8 per cent. by compression to 220 lbs. per square inch. Pennsylvania naphtha gave 51 cubic feet of 46-candle gas, which lost 12 per cent. by compression. Lima crude oil yielded 63 feet of 56-candle gas; and Lima naphtha, 72 feet of 46-candle gas—the loss by compression being between 11 and 12 per cent. in each case.

After some considerations as to the possibility of a cheap fuel gas, the reading of periodicals and literature relating to the gas industry was strongly recommended. The Association was advised to adopt the 2000 lb. ton as a standard, instead of the 2240 lb. ton. Several other matters relating to the affairs of the Association were also noticed.

A paper on "The Practical Efficiency of a Semi-Regenerative Furnace" was read by Mr. J. W. Dunbar, of New Albany, Ind. The author said that, while the disadvantages attendant upon the old form of firing were well known, the regenerative furnace was costly in construction, and required a greater scientific knowledge for its successful operation than some gas engineers possessed; so that it could scarcely be applied in a works of less capacity than 200,000 cubic feet per day. The semi or half-depth regenerative furnace was simple, and cheap in first cost, easy to operate, required less labour and attention than either the direct-firing or the regenerative furnace, and therefore met the requirements of small gas-works. At the same time they included the best qualities of the regenerative kind. In most cases they could be applied to existing settings of threes or fives, at an additional cost of about £5 per retort. They could be arranged to heat the primary as well as the secondary supply; but he had not found much advantage therefrom. A slow draught was necessary for the economical working of a furnace. When the top sight-hole in the front was opened, the flame should slightly protrude therefrom. The dampers should be arranged to secure this condition, and should be closed during clinkering, which was only required once in from four to seven days. The use of steam rendered the clinker soft and easy of removal. The grate-bars required to be shaken about every four hours. Though theoretically the steam caused waste of heat, in practice it kept the bars clear, and absorbed heat just where there was an excess; giving it up again in the setting, where it was wanted, and therefore was an advantage. It prolonged the life of a furnace. The benefit of drawing coke direct from the retort into the furnace was well known. The interior of the retorts should be scraped at least three times a week to prevent accumulation of carbon. With benches of sixes set on this principle, a production of upwards of 10,000 cubic feet per retort should be maintained, with a consumption of less than one-third of the production of coke. In his settings, four of the retorts were 26 in. by 15 in. by 9 ft.; and they received 375 lbs. of coal per charge. The others were 14 in. by 22 in., and they took 325 lbs. The periods of charging was every four hours. He had been able, on an emergency, to work off another 25 lbs. per retort. His results did not come out so good as this on the average, because the retorts had to remain idle, or be kept going with lighter charges, some of the time, on account of variations in consumption. But the monthly averages showed more than 9000 cubic feet per retort per day, 4·8 to 4·9 cubic feet per pound of coal, and 33 to 37 per cent. of coke used. During December, however, a production of 10,000 cubic feet per retort and upwards was maintained for several days. He had been troubled with stoppages in the ascension-pipes, and found a small stream of water admitted at top an advantage.

In reply to questions, Mr. Dunbar said he used the best Pittsburgh coal. The furnaces were the Laclede and the Parker-Russell, with horizontal flues that could be easily cleaned. The boiler was situated immediately at one end of the retort-stack, so that the furnace gases could be passed direct to the chimneys (there being a separate chimney to each setting), or diverted to take a course through the grate-bars and round the boiler. If there was too much steam, a portion could be bye-passed; and if there was not enough, solid fuel could be introduced under the boiler in the usual way. The boilers were of the horizontal tubular pattern, with chimney 40 feet high, so as to give a good draught.

(*To be continued.*)

# REGISTER OF PATENTS.

**Manufacture of Ammonia.**—Baudouin, H., and Escarpit, P. F., of Paris. No. 7247; May 9, 1890. [8d.]

This invention relates to the manufacture of ammonia by subjecting a mixture of nitrate of soda and a hydrocarbon (such as naphthalene) to decomposition by heat. At a temperature of about 600° C., the oxygen of the nitric acid and the carbon of the hydrocarbon form carbon dioxide, which combines with the soda, forming carbonate of soda; while the nitrogen of the nitric acid and the hydrogen of the hydrocarbon combine, forming ammonia. The reaction is effected in an inclined retort, within which is a travelling chain scraping the bottom. The thorough mixture of nitrate of soda and hydrocarbon is introduced by a branch-pipe at the upper end of the retort; the ammonia gas ascending by a branch-pipe extending upwards from the lower end, and the carbonate of soda descending by a branch pipe extending downwards from the lower end. The ammonia is collected on lime, which takes up the water and the carbon dioxide not absorbed by the soda.

**Guiding and Controlling Gasholders.**—Pease, E. L., of Hurworth-on-Tees. No. 7616; May 16, 1890. [11d.]

This invention relates to the guiding and controlling of gasholders, so as to support and balance them in their working position, by means of wire ropes or their equivalents, after the manner described in patent No. 18,272 of 1888.

*Fig. 1.*

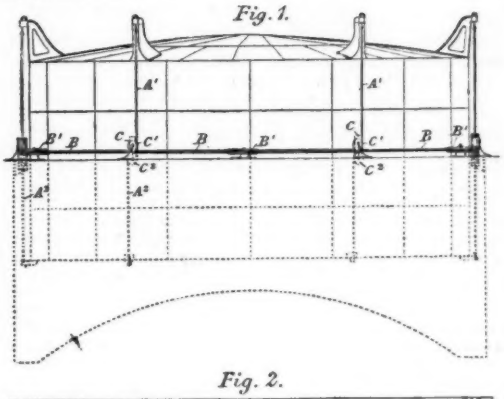
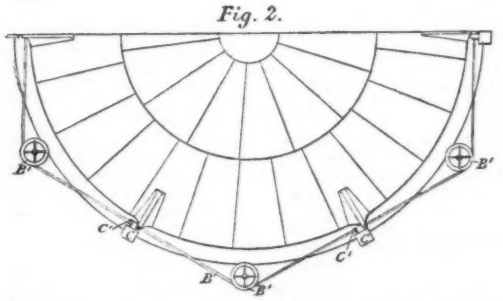



*Fig. 2.*




In explaining how the invention is carried into effect, the term "check-rope," "coupling-rope," "coupling-bar," or "compound check-rope" is employed in the same sense as in the former specification; the object of the present invention being merely to "modify the means or appliances for operating the check-ropes in several details of construction, by which what may be termed the circulating arrangement of operating the check-ropes may be carried out without using a separate endless coupling rope, or may be combined with what may be termed the alternating arrangement of operating the check-ropes." A further object of the invention is to modify the alternating arrangement of operating the check-ropes, in order to adapt it more readily to multiple-lift holders.

In figs. 1 and 2 an elevation and corresponding half plan illustrate a single-lift gasholder controlled by the circulating arrangement of operating the check-ropes.

Instead of employing top and bottom check-ropes having separate connections with the circulating coupling rope or bar, the check-ropes $A^1$ $A^2$ are connected to the top and bottom curbs, and to one another, in such a manner that the horizontal portions B of the check-ropes serve the purpose of an endless coupling-rope, which circulates to the right or left as the gasholder rises or falls. Twin pulleys $C^1$ $C^2$ working in overhanging pulley-blocks C are provided round the tank side, at distances apart which are not less than the vertical travel of the check-ropes. The lower portion $A^2$ of a check-rope connected to the bottom curb below one of these pulley-blocks is carried round the lower pulley $C^2$ in a horizontal direction past the next pulley-block, and round the upper pulley $C^1$ in some pulley-block beyond to its connection with the top curb. In this way a top and bottom check-rope $A^1$ $A^2$, with an intervening horizontal connection form a ⌐-shaped figure. Another check-rope, having its lower portion $A^2$ connected to the bottom curb below an intermediate pulley-block C, is similarly carried round the lower pulley $C^2$, past the next pulley-block, and round the upper pulley $C^1$ in some pulley-block beyond, and up to its connection with the top curb. These forma precisely similar ⌐-shaped figure round the holder. By this arrangement, the horizontal or circulating portions B of the combined upper and lower pairs of check-ropes overlap each other from pulley-box to pulley-box; the horizontal portions B being united or tied together by any suitable coupling at such points as will not foul the pulley-boxes. They thus serve the purpose of a circulating coupling rope. The pulleys $B^1$ on the tank side are employed to prevent the check-ropes from fouling the holder, and also for keeping the circulating portions of the check-ropes in tension.

*Fig. 3.*

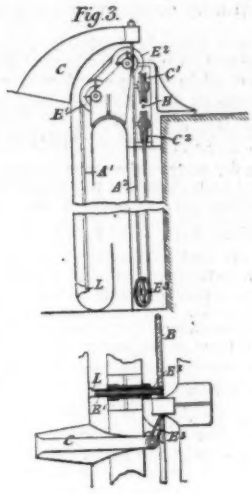



Fig. 3 illustrates a part sectional view and a corresponding plan view of the circulating and alternating systems combined to operate together for guiding and controlling a two-lift holder. Here the following combination of parts is employed: L is a holdfast secured to the bottom curb of the inner lift; and C is a "gooseneck" extending from the top curb thereof, with a pulley $E^3$ pivotally attached to the bottom curb of the outer lift. A check-rope $A^1$, secured to the holdfast, is trained over pulleys $E^1$ $E^2$ provided on the "dip" of the outer lift, and round the pulley $C^1$ at the tank side to its connection with the coupling-rope B, which is an endless rope surrounding the holder. The check-rope serves as the lower check-rope of the inner lift, and as the upper check-rope of the outer lift. A check-rope $A^2$ secured to the gooseneck C is brought down under the pulley $E^3$ pivotally attached to the bottom curb of the outer lift, and round the pulley $C^2$ to its connection with the coupling-rope. This check-rope serves as the upper check-rope of the inner lift, and the lower check-rope of the outer lift. Both check-ropes are diverted horizontally in opposite directions to their connections with the coupling-rope B, so that as one check-rope is taken up by the vertical movement of the holder, the other is given out.

In applying this part of the invention to a three-lift holder, the check-rope attached to a holdfast at the bottom curb of the top lift is trained over a pulley on the dip of the intermediate lift, round the pulley pivotally attached to the bottom curb of the outside lift, and round one or more pulleys to its connection with the coupling-rope. This check-rope serves as the lower check-rope to the top and bottom lifts, and as the upper check-rope to the intermediate lift. At another part of the holder a compensating check-rope is provided, which serves as the upper check-rope to the top and bottom lifts, and the lower check-rope to the intermediate lifts. This check-rope is secured to a gooseneck extending from the top curb of the top lift, and is brought round a pulley pivotally secured to the bottom curb of the intermediate lift, over pulleys on the dip of the outer lift, and round one or more pulleys to its connection with the coupling-rope. The two check-ropes are connected in opposite directions with the coupling-rope, so that as the vertical movement of the holder takes one up, it gives the other out.

Referring to the alternating arrangement of operating the check-ropes according to this invention—in which the ends of each check-rope are secured to fixed brackets, which serve as a holdfast at suitable parts of the tank side—the patentee next describes the combination of parts brought into use in applying it to a two-lift holder. Two pulleys are pivotally attached to the bottom curbs of the inner and outer lifts respectively, at suitable positions relatively to the holdfasts. The check-rope from the holdfast at one side of the holder is led down under the bottom curb pulley of the outer lift, and up again across the dome of the holder, and down between the lift at the other side, round the corresponding bottom curb pulley provided there, and up again over the dip of the outer lift to the holdfast at the tank side. Intervening pulleys are employed as required on the dome of the holder and the "dip" of the outer lift. It will be observed that, while the outer lift is stationary, and the inner lift is rising alone, the loop in the check-rope which passes round the bottom curb pulley of the inner lifts is taken up, and the check-rope is drawn across the dome of the lift to the opposite side when the two lifts are cupped. The loop similarly formed by leading the check-rope round the bottom curb pulley of the outer lift, is similarly taken up while the check-rope is drawn across the dome in the opposite direction. When the lifts fall again, the reverse operation takes place, in which the check-rope is drawn across the dome of the holder round the bottom curb pulley of the outer lift, until the loop round it has regained its original length and the inner lift its original position.

The above-described mode of operating the check-ropes can be similarly applied to three-lift holders; an additional loop round a pulley pivotally attached to the bottom curb of the extra lift being required to give out and take up the extra length of the check-rope, and so on for any number of lifts. Three check-ropes intersecting triangularly will (says the patentee) generally be found sufficient to balance the holder in the working position.

**Charging and Drawing Gas-Retorts.**—D'Iszoro, L. S., of Manchester. No. 8930; June 10, 1890. [1s. 1d.]

This invention, relating to machinery for charging and drawing gas-retorts, has for its principal object the saving of manual labour; also the facilitating of such labour whilst performing the work, and distributing the coal more evenly in charging, so as to facilitate its carbonization.

For this purpose a scoop is employed which has the shape of a rectangular box, open at the top, with a loose sliding bottom, consisting preferably of a plain plate strengthened with a longitudinal web in the middle, and made of an elliptical, oval, or semi-circular form, (in cross-section) according to the shape of the retort. The body of the scoop is formed of sides and ends holding the necessary quantity of coal, which will drop when the bottom is withdrawn. To make it work satisfactorily, the body of the scoop is intersected with a number of cross bars, placed high enough to be clear of the coal charged into the retort when pulling out the body of the scoop from the retort! and to these bars plates are hinged, which will swing inwards, but not outwards. Thus when pulling out the bottom of the scoop, they will be firm, and hold the coal so that it drops upon the bottom of the retort; but when withdrawing the body of the scoop, the plates will swing back, and thus come out easily with the scoop.

For inserting the filled scoop into the different retorts, withdrawing the bottom, and subsequently the body of the scoop mechanically, an elaborate arrangement of mechanism—preferably worked by means of rope-gearing—is described. The patentee then proceeds: From the preceding description, it will have been understood that the sides of the scoop serve to hold the necessary quantity of coal; whilst the bottom of the scoop serves to hold and also to empty it. Hence they must be pushed together in the retort; but the sides secured to the inside carriage must stay in the retort till the bottom of the scoop is withdrawn, and the coal emptied into the retort. To perform this operation the sides of the scoop with its inside carriage are pushed into the retort by the outside carriage. Then, as each of the chains attached to the scoop-guide is provided with two lugs, dogs, or drivers at a convenient distance one from the other, when the scoop is drawn back and at rest, one pair of lugs on the lower side of the chains is approximately opposite to the chain-wheels at the back end of the scoop-guide. The outside carriage is provided with fast catches, sliding catches, and levers connected to the latter. When the scoop is at rest, the catches permanently fixed to the outside carriage at the back of the chain-wheels are farthest from the retort mouth, and reach up to the upper side of the chain; while the sliding catches are placed in front of the chain-wheel, one projecting on each side of the scoop on the level of the lower side of the chain, and guided at their outer ends in slots provided for the purpose in the outside carriage, and with their inner ends in a bracket, which is secured in the middle of the same carriage. The levers to work these sliding catches rock on pins in this bracket or in separate brackets, and are connected with their bottom ends to their respective sliding catches, and with their upper ends reach to the inside carriage, where eventually they come into contact with fast cams fixed to this carriage. When the scoop shaft is set to work, the chain-wheels driven by the spur-wheels will also revolve; and the chains with their lugs on the lower side of the chain, which were between the sliding catches and the fast catches, encounter and push the sliding catches, and with them the combined scoop, into the retort till they reach the chain-wheels near the retort mouth. The stroke of the scoop being then completed, the lugs leave the sliding catches; passing with the chains round the chain-wheels to the upper side, and meet directly the fast catches at the back end of the outside carriage. By these means they withdraw the bottom of the scoop from the retort, and bring it to its position of rest. While this is done, the sliding catches are drawn inside the carriage by means of the levers encountering the cams fixed to the inside carriage. Thus, when the bottom of the scoop is brought to rest, the chain lugs cannot take hold of these sliding catches, which are now drawn in, and pass them. Meantime the other pair of lugs on the chains seize the inside carriage and sides of the scoop, and bring it to its place of rest, when the cams on the inside carriage push the sliding catches of the outside carriage out again, and make them ready for further work.

The inside carriage is operated in the following manner: When the combined scoop reaches its required distance in the retort, catches on the top part of the scoop, which may be sliding or hinged, take hold of the scoop guide, which is provided with notches for the purpose, and the scoop sides will rest so till the bottom is withdrawn. As soon as the bottom is withdrawn from the retort with the one pair of chain lugs, the other pair of lugs encounters the catches, detaches them from the notches, and by their means brings the inside carriage with the scoop sides, &c., back to its primitive position of rest, where again the combined scoop is ready to receive a fresh charge of coal. But before the inside carriage comes quite to rest, it brings with its fast cams, the sliding catches on the outside carriage into working order, and also returns its own moveable catches to their original position by means of sam, which for the purpose is affixed to the outside carriage. At the same time another cam throws the machine out of gear and stops it.

The specification next describes, in great detail, the levers and other arrangements necessary for putting the various parts of the machinery in motion in due order. Following on with the mechanism for the charging of the scoop with coal, the patentee points out that he uses a hopper of large enough to hold a quantity of coal sufficient for several scoops. It is provided with sliding or rolling doors, which, when withdrawn, allow the coal to drop from the hopper into the scoop; and it is secured to the scoop-frame by means of brackets provided with grooves to receive the sliding doors. To open and shut the doors automatically, three different arrangements may be used: Firstly, by fixing lugs or catches to the sliding-doors, and the other lugs or tappets for working the door lugs to the scoop; secondly, by securing to the sliding-door rods which pass along the scoop, and projections, tappets, or loops, to the scoop, by means of which the rods, and consequently the doors, may be opened and shut; thirdly, by stretching a chain or rope along the scoop, and attaching the ends of it to the sliding-doors, and consequently, by pulling one way or the other, the door will be shut or opened. The inventor prefers the first arrangement, which works as follows: Four catches are attached to the sliding-door—viz., two for opening and two for closing. Similarly four lugs or tappets are attached to the scoop—two of them on the front end of the scoop and to the top part for opening the sliding-doors, and two other cams to the bottom part of the scoop and in its rear, for shutting the door. When the scoop is entirely at rest, the sliding-door on the very front end of the scoop, is open; and this part of the scoop is consequently filled up with coals from the hopper, and as soon as the scoop is set in motion to go into the retort it will be also gradually filled up with coal. When the required length of the scoop has been filled, and before it has been quite filled up, the tappets on the bottom part of the scoop gradually push the sliding-door by means of its catches till the admission of coal is quite shut off. Here the catches give way; the scoop completes its full stroke into the retort; and after having emptied its charge comes back. But before it comes to its primitive position of rest, it opens again the sliding-door with the tappets on the top part of the scoop, and lets the coal drop again into the scoop. The front of the hopper is provided with a cut-out or opening in such a manner that it will just permit the coal in the scoop to pass through, and will thus regulate and give an even charge of coal to the scoop, and also will prevent the door jamming against the coal or front of the hopper, which otherwise might occur, especially when using large lumps of coal.

The machinery for drawing the coke from the retorts consists of similar arrangements as for the charging-machine—viz., the general machine-frame and also the general driving motion; but, of course, a rake for drawing. The rake-guide, which is suspended like the scoop-guide, is a double one; the outside frame being made of two bars of convenient section of steel or iron, braced together, and suspended by ropes or chains similarly to the scoop-guide. The inside or swivel frame is formed of two channel irons braced together with their flanges inward for the rake carriage to work in. About the middle of its length, this guide is suspended on pins attached to the outside frame, so that it can swivel in it. The front end of the swivel frame is provided with brackets and tension tackle for chain-wheels, and the back end (that farthest from the retort) is provided also with brackets carrying the rake driving-shaft, with chain-wheels, and also a helical wheel, which receives motion from an upright shaft, similarly as in the charging-machine. When the driving-chains are stretched over these chain-wheels, and tightened by means of the tension tackle, a carriage is secured to the chain; and by setting the rake driving-shaft in motion, either one way or the other, the rake carriage will be worked forward or backward. Where the retorts are very shallow, the mechanism is arranged so that the head of the rake, whilst entering into the retort, will be almost horizontal either way—*i.e.*, either toward the front or the back. But as soon as it reaches the required distance in the retort, and just before the reversing motion starts to work the rake carriage and rake backward, the rake-head will take automatically its vertical position in the retort; and consequently, by pulling it out from the retort, it will withdraw the coke.

The specifications for this invention extend to thirteen closely-printed pages; and the complete one is illustrated by six sheets of detail drawings. The four main claims advanced by the patentee are: 1. In apparatus for charging retorts, a scoop adapted to be projected as a whole into the retort, and consisting of a bottom intended separately withdrawn from the retort so that the coal in the scoop falls into the retort, and of a body provided with division-plates free to swivel forwards only on their upper ends, so that they prevent the coal from being drawn out of the retort with the bottom, and swivel forwards when the body is withdrawn, so as not to disturb the deposited coal. 2. A charging scoop consisting of a body and a bottom adapted to be separately operated, the bottom being provided near its rear end with two sets of catches; the scoop being fed as a whole into the retort by the action of one pair of lugs, on a continuously revolving chain, on the forward set of catches, and the bottom being again immediately withdrawn, to deposit the coal in the retort, by the same lugs acting on the rear catches; and the body being provided with hinged or sliding catches taking into notches in the guide-frame, when the scoop is completely fed forwards, so as to prevent the body being withdrawn with the bottom, and again raised and seized when the bottom is back in its normal position by a second pair of lugs, on the chain, which carry the body back to its initial position. 3. Charging the scoop automatically as it is fed forwards into the retort from a hopper fixed at the front end of the machine, and provided with a sliding bottom opened by a tappet on the scoop on its return to its initial position, and closed by another tappet on the scoop slightly before it is completely within the retort. 4. In apparatus for charging as well as drawing gas-retorts, preventing the traversing mechanism from being put in operation when the scoop or drawing rake is within or partially within the retort, by means of a latched link engaging with the scoop or rake guide-frame and attached to the lever controlling the two clutches through which the traversing and scoop or rake driving mechanisms are respectively transmitted; and of a cam on the scoop or rake carriage which raises the link free of the frame when the scoop or rake returns to its initial position, so that the clutch lever can then be operated as desired.

## APPLICATIONS FOR LETTERS PATENT.

9716.—Allen, J. F., "Improvements in the manufacture of illuminating gas." June 9.

9778.—Freund, E., "Improvements in the construction of gas-holders." June 9.

9807.—Taylor, G., "Improvements in and connected with apparatus for the loading of vessels, and the transfer of coal and other substances from one place or level to another." June 10.

9817.—Molison, A. R., "Improvements in apparatus for inducing electric sparks for gas lighting and like purposes." June 10.

9850.—Laybourne, R., "Improvements in apparatus for shipping or transferring coal or other materials." June 10.

9865.—Dawson, H. T., "Improvements in gas-engines." June 10.

9931.—Withers, S., and Covert, D'E. S., "Improvements in or relating to vibrating gas-engines." June 11.

9968.—Attewell, T., Clayton, H., and Selby, E., "An improved gas-burner." June 12.

# CORRESPONDENCE.

*[We are not responsible for opinions expressed by correspondents.]*

### Mr. Grafton on the Standard of Light.

SIR,—In reference to Mr. Young's letter in your last issue, expressing astonishment at my condescending to countenance a jet photometer as sufficiently reliable for the purpose of readily indicating any change of quality during the making of my experiments, I have only to say that it answered the purpose remarkably well, since the quality of the gas was not very variable. It may, however, be as well to mention that I have used a Methven screen for corroboration. The time necessary to perform a full series of tests is less than an hour, which is made up thus: 11 to 13 minutes burning before starting, four tests each of 10 minutes, intervals amounting to six minutes—total, 59 minutes. Mr. Young writes that "such a change did take place," which would lead you to think that I recorded tests when changes occurred, although in my last letter I distinctly stated the contrary. With regard to Table IV., the change of quality was verified as is there shown.

My great objection to "B" is that its light is not uniform. Consequently, reliable or uniform results are not always to be got with it, unless you keep an eye upon the curvature of the wick, to see that it does not change, which it will do if left alone.

So far as the illustrations are concerned, I can only add that to photograph candles is no easy matter, as the flickering and reflected light offers serious drawbacks to the ideal production of a candle. However, they are, in my opinion, very good; and if they do not sufficiently represent the photograph sent in, they represent very well what I have to say regarding them.

Allow me also to inform Mr. Young that uniform results can be obtained by employing other forms of wicks, as I have already shown in my paper. It is a simple thing to get uniform results if you only see that the wick keeps a certain curvature or shape. Mr. Young states that he has endeavoured to show that "B" is the best shape for producing uniform results; yet he gives no results by any other shape, which clearly shows that he is not justified in making this statement.

I am glad Mr. Young has again referred me to my own figures corroborating his; for either he has misconstrued my explanation or I have failed to make myself understood. On p. 790 (not p. 791) I have stated that "A" results do not differ more than half a candle. Now, this does not apply to "B," which is erroneously represented as "A," to which attention was drawn on p. 839. In Table I., I have endeavoured to deal with "A" and "B" at one and the same time. I thought it would be easier to compare the results obtained with the different photometers, if I calculated out the light emitted by each average of tests. I have assumed that "A" tests were made with one candle, since I was obliged to have some starting-point. The whole of the tests under "Natural Bend" then are represented by one candle. Those under "Quarter Bend" show how much more light "B" develops than "A"; and perhaps I ought to have stated the "quarter-bend results are all (with one exception) within 1 per cent. of the aggregate of the photometers, yet giving 6·6 per cent. more light than "A." By this I do not advocate "B," nor do I show that the individual tests differ at all, but only that the averages of the individual tests differ from the aggregate of those averages, which show that the photometer influenced the difference between "A" and "B" very little.

It is laid down by Act of Parliament that a standard candle shall burn 120 grains of sperm per hour; and it may be safely assumed that, unless it does so when burning naturally, it does not emit a light of one candle power. By calculation, I find that at this rate one grain of sperm gives a light of ·0083-candle power. If, however, I resort to unfair treatment of the candle, I can get ·008883 and ·00695 candle power emitted per grain of sperm burnt by "B" and "D" respectively. With "A" under natural conditions I get actually ·00844-candle power emitted per grain; and this is obviously the nearest to the standard. Considering these facts, I cannot see how Mr. Young can believe it is a matter of opinion which shape is used. I cannot see how Mr. Young has arrived at his conclusion that consumers "are entitled to the candle which produces the maximum amount of light." To me, it appears that they are entitled to the candle which produces one candle power and nothing more.

I still maintain what I have said on the subject of soot. "A" is not the very shape to produce "cauliflower tips," as Mr. Young thinks; the wick is not straight enough for the formation of such "tips."

As regards my authority for stating that standard candles were recently altered, I regret that I am not at liberty to satisfy Mr. Young that such was the case. I can quite understand his knowing personally that candles having 23 threads in each strand are still being employed, since candles are again being manufactured in the old way; and, since the new form of candles was manufactured only for a period of a very few months, it is quite possible that Mr. Young never had one.

*Upton Park, Essex, June 19, 1891.* W. GRAFTON.

### Re-Burning Spent Lime.

SIR,—Not being directly connected with the gas industry, it was only by chance that I saw your issue of the 2nd inst., containing Mr. Hislop's letter on my improved process for re-burning spent lime.

I hope Mr. Hislop will believe me when I assure him that I have no intention or wish to take any credit justly due to him for being the first to propose the burning of spent lime in a revolving furnace; but at the same time I should like to hear from Mr. Hislop if his ingenious ideas were ever carried into practice, and with what result.

I fear your reporter has somewhat confused my remarks at the meeting, so that I do not wonder that Mr. Hislop is mystified. The apparatus consists mainly of two revolving chambers lined with fire-brick. The upper one is the furnace for burning the lime; and the lower is the cooling chamber for the already burnt lime and the heating chamber for the incoming air for supplying the furnace, which is heated by crude producer gas.

There are these wide differences, therefore, between my system and Mr. Hislop's furnace—viz., the application of gaseous fuel and the addition of the cooling chamber and air regenerator. But as Mr. Hislop's patent rights have lapsed, it is perhaps no use pursuing the subject further.

In conclusion, I should like to correct Mr. Hislop's idea that my experiments have only been on a "laboratory scale" (which is quite incorrect), and to inform your readers that I am now putting up plant which will I hope burn more than a ton of lime per hour, with a consumption of 3 cwt. of coal.

9, *Victoria Street, S.W., June 15, 1891.* WILFRED STOKES.

### Mr. Edwards's Gas Institute Paper.

SIR,—Will you permit me to say that I am not to blame for the disappointment, if any, caused to the members of The Gas Institute by the withdrawal of my paper at the recent annual meeting.

When a paper has been delivered in time for two revisions of it to be made, the asking for further revision on the last day of the meeting appeared to me to be simply humbug; and, not being accustomed to submit to that sort of thing, I elected to withdraw the paper. There is no manner of doubt that by my so doing the desire of those members of the Council who asked for its revision was accomplished.

I am well aware that the reading of the story of the methods adopted to endeavour to secure the establishment of the Taunton Electrical Company, would not be acceptable to many other persons besides those more immediately and locally interested. They may, however, rest assured that the story will be told whether they wish it or not, and that the longer it is deferred the more determined will be the *exposé* when it does come.

It only remains for the further gratification of these gentlemen to add that my connection of over eighteen years with The Gas Institute ceases on the 31st of December next.

*Taunton, June 17, 1891.* A. EDWARDS.

### The Effective Duty of Gas in Ventilation.

SIR,—My communication on this subject in the last issue of the JOURNAL dealt with it entirely from a commercial and practical working point of view; the object being to prove the most economical method of utilizing gas for the purpose of ventilation. If we calculate the heat actually utilized, we shall find, as would be expected, that an exceedingly high duty is obtained. Taking the bulk of 1 lb. of air at 62° Fahr. 13·16 cubic feet, and its specific heat for equal volumes at 0·169 (water being 1), we get, allowing 1-40th for expansion, an average duty of 584 heat units per cubic foot of gas; the loss by radiation from the flue being only about 1-7th of the whole theoretical heat available. When we consider that the consumption of a cubic foot of gas can be made to exhaust upwards of 2400 cubic feet of air—the necessary heat to raise the column of air to the required temperature being 6-7ths of the total theoretical heat of the fuel used, the balance being utilized in keeping the sides of the shaft warm—we may consider this method of using gas is as perfect as could be desired, provided the current in the shaft does not exceed a speed of about 200 feet per minute.

*Warrington, June 17, 1891.* THOS. FLETCHER.

### The Taxing of Sulphate of Ammonia Plant.

SIR,—I am glad to see that the Council of The Gas Institute have directed their attention to the licence to be paid for sulphate apparatus; but they might go a little further and take in the smallest class.

I happen to be interested in a gas company carbonizing about 600 tons of coal a year. We have erected sulphate apparatus at a cost under £100, and make about 5 tons of sulphate per annum. The profit on this, after allowing for depreciation, &c., is only about £20; and, therefore, we are taxed to the extent of nearly 20 per cent. My friend Mr. Jervis, of New Swindon, is working a smaller set than this—viz., from 400 tons per annum; and I believe there are several plants of about this capacity in different parts of the country.

Cannot something be done to relieve such small concerns from the disproportionately high tax of £3 3s., or as some would make it, £3 13s. per annum?

*Salisbury, June 17, 1891.* N. H. HUMPHRYS.

### Ammoniacal Liquor Meter.

SIR,—Have any of your readers experience of the working of liquid meters to measure the supply of ammoniacal liquor to sulphate stills? A reliable meter for this purpose is much to be desired. It must, of course, be constructed of materials not injuriously affected by the liquor; and should, I think, be positive, not inferential, in its registration. Low-pressure meters are not always adaptable.

*June 18, 1891.* CHEMICUS.

### Mr. Price's Arrangement of Hydraulic Main.

SIR,—In the "Register of Patents" in the last issue of the JOURNAL, I notice that Mr. J. Price, of Coleshill, has taken out a patent for certain improvements in apparatus for use in the manufacture of gas. It is rather a curious coincidence that I should have been working on precisely the same lines. Some three years ago, I had in use an arrangement, as an anti-dip, exactly similar to that patented by Mr. Price. But circumstances have prevented me continuing and completing my experiments; and I did not feel justified in protecting the idea until I had done so. I have in my possession at the present time the bell, hood, or cap—whichever it may be called—then in use. It is made of tinned plate 8 inches in diameter by 5 inches deep, having in the circumference 16 slotted holes, each ¼ inch wide by 1½ inches long. I had also contemplated applying the same principle to washing the gas, but in a separate vessel; and I had a rough model made to show the action, either as an anti-dip or a washer.

*Chester Gas-Works, June 20, 1891.* R. HUNTER.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF LORDS.

The following progress was made with Bills last week:

Bills read the first time: Electric Lighting Provisional Orders Bills (Nos. 8, 10, and 12).

Bills read a second time and committed: Electric Lighting Provisional Orders Bills (Nos. 5, 6, 7, 9, and 11).

Bills reported: Electric Lighting Provisional Orders Bills (Nos. 5, 6, 7, and 9); Gas and Water Provisional Orders Confirmation Bill; Penmaenmawr Local Board Bill; Rhyl Gas Bill; Southwark and Vauxhall Water Bill [*locus standi* of petitioners disallowed]; Stourbridge Gas Bill.

Bills read the third time and passed: Barmouth Local Board Bill; Fylde Water Bill; Garw and Ogmore Gas Bill; Gas Provisional Orders Confirmation Bill; Water Provisional Orders Confirmation Bill; Western Valleys (Mon.) Water Bill.

A petition against the Southwark and Vauxhall Water Bill was presented from the Corporation of London.

## HOUSE OF COMMONS.

The following progress was made with Bills last week:—

Bills read the first time: Gas Provisional Orders Confirmation Bill; Water Provisional Orders Confirmation Bill.

Bills read a second time and committed: Electric Lighting Provisional Orders (No. 10) Bill; Glasgow Corporation (Partick, Hillhead, and Maryhill) Gas Bill.

Bill reported: Malvern Water Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders Bills (Nos. 8, 10, and 12); Local Government Provisional Orders (Gas) Bill.

## HOUSE OF LORDS COMMITTEE.

### Tuesday, June 9.

(*Before the Earl of* LAUDERDALE, *Chairman; Viscount* POWERSCOURT, *Lord* SCARSDALE, *and Lord* SANDFORD.)

RHYL GAS BILL.

This Bill, which was promoted by the Rhyl Gas Company for the purpose of obtaining statutory and further capital powers, came before their Lordships to-day. It was considered by a Committee of the Lower House in March last (see *ante*, p. 600), who passed it with certain amendments; an important one being the insertion of a clause to authorize the Rhyl Improvement Commissioners to purchase the Company's undertaking.

Mr. PEMBROKE STEPHENS, Q.C., and Mr. RIGG appeared for the promoters; the opponents (the Commissioners) being represented by Mr. BALFOUR BROWNE, Q.C., and Mr. J. D. FITZGERALD.

Mr. PEMBROKE STEPHENS, in opening the case, said the Bill was one for incorporating and for conferring further powers upon the Rhyl Gas Company. Although the Company had been in existence for upwards of 40 years, it had never been incorporated and placed under the usual statutory provisions. After describing to the Committee the difference between the powers of an incorporated and an unincorporated company, the learned Counsel went on to say that, in the case before them, it was intended, among other things, to put in force what was known among gas companies as the sliding scale, which had been found to operate beneficially in protecting the consumers against capricious or unnecessary increases of price, and in enabling a company to increase their dividends if they were able to reduce the charge below the standard allowed. The Company had fixed their price in the Bill at what they had been charging hitherto—viz., 4s. per 1000 cubic feet—which was very moderate in these days, when strikes were in the air, and there was electric lighting to compete with, and when gas companies must look to the future. He then dealt with the past history of the Company and its present position, with the view of showing that it was essential that the present application to Parliament should be made. He said that in 1848 a private Gas and Water Company was started; and the Rhyl Improvement Commissioners were established in 1852. In 1869 the gas undertaking was purchased by a Company formed under the Companies Clauses Consolidation Act. To show the increase which had taken place since then in the sale of gas, he might say that in 1870 (the year following the purchase of the undertaking) the consumption was 4,883,000 cubic feet; while in 1890, it amounted to 18,250,000 cubic feet. Rhyl was a favourite North Wales watering-place, where, at certain periods of the year, there was a great influx of visitors; and as there was an exceptional demand and extraordinary expense during the time the season lasted, the Company had then to make an exceptional effort. The Improvement Commissioners, who were the Urban Sanitary Authority, objected to the proposals of the Company, which they contended would injuriously interfere with, and affect their rights under the Rhyl Improvement Acts, 1852 and 1872, and the Rhyl Provisional Order, 1882, which conferred special powers upon them. By section 34 of the Act of 1852, it was provided that it should be lawful for the Commissioners to manufacture gas, and provide gasholders and all apparatus and machinery necessary for the purpose, and purchase or rent any land, not exceeding five acres, which might be necessary for the establishment of works, &c.; but it was provided that, before commencing any operations, the Commissioners were to give notice in writing to the owners of the gas-works already established, stating their willingness to purchase, as the owners were willing to sell, their undertaking upon terms to be settled between that body and the Company, or, in case of difference, to be ascertained and fixed in the manner provided for by the Land Clauses Consolidation Act, 1845. The effect of this clause was that the Commissioners were, if they chose to do so, armed with power to manufacture gas, and also to buy out the existing Gas Company by agreement, if the Company chose to sell; but there was no element of compulsion about it, from first to last. But from 1852 until a certain date in the present year the Commissioners had never taken any step whatever under that section. They had never made any inquiry of the existing Company, had never put forward any offer to purchase, and had never set about establishing gas-works for themselves. Last year, the Commissioners went to the Local Government Board with the object of getting section 34 of the Act of 1852 repealed. The Town Clerk of Rhyl appeared in support of that application, and stated, as a reason for the section being repealed, that the Company was not authorized by Act of Parliament, and the Commissioners thought a Company without statutory powers should not exist in these days in a town like Rhyl. He further stated that the Commissioners had no control over the quality of the gas or the profits of the Company, who were not amenable to any of the regulations of the General Acts relating to gas-works. The Commissioners said that one effect of the proposed alteration would be that possibly the Company would apply for statutory powers; and they would be well satisfied if the Company did so, as it would give the Commissioners proper control over them. The Local Government Board Inspector who was accustomed to deal with such matters, saw at once what the real object of the application was; and the Board eventually refused to repeal section 34 of the Act of 1852. The Company had full notice from the Commissioners of their views; and their proper answer was: "If you really find fault with us for not being a statutory Company, the obvious thing for us to do is to go to Parliament as soon as possible, and ask them to make us one; and we are quite prepared to meet you in a fair spirit, to discuss clauses with you, and to make any arrangements for the joint good of the town and yourselves." But, viewed in the light of the proceedings last year, they did not believe that the House of Lords would consent to give the Commissioners the powers for which they asked, any more than the Local Government Board had done. The Commissioners had spent four days in trying to get the House of Commons to accept their view; but they were not able to show any precedent for conferring compulsory powers of purchasing the undertaking under the existing circumstances. Then the Commissioners stated that, in accordance with the provisions of the Act, they had given notice to the Company that they were prepared to purchase their undertaking, and that the Company refused to sell upon arbitration terms. But, until the Bill had been read a second time in the House of Commons, no movement was ever made by the Commissioners. On the 21st of February in the present year the Commissioners wrote to ask if the Company were willing to sell; but they had no Bill in Parliament, and they had not been to the Local Government Board to obtain any money wherewith to buy. As the Commissioners last year made it a ground of complaint that the Company had not statutory powers, they were responsible for the present Bill, by which, as it expressly repeated the provisions of the Act of 1852, the position of the Commissioners would be in no respect altered; while as regards their power to purchase the Company's undertaking, they would be in just the same position as if the Bill was not passed at all.

Mr. FITZGERALD: If the Company refuse to agree to sell, what is the advantage of that position?

Mr. PEMBROKE STEPHENS: We refuse to agree now; therefore you will be in no worse position than you are now.

Mr. *S. Perks*, J.P., examined by Mr. RIGG, said he had been Chairman of the Rhyl Gas Company since its formation as a limited liability undertaking in 1869. He explained that the object with which he and his fellow-Directors joined the Board was to effect a considerable reduction in the price of gas, and also to keep the management and the concern in the hands of responsible people. They purchased the private undertaking for £6019; and the registered Company had a nominal capital of £10,000. Since the works had become the property of that Company, there had been a great increase in the consumption of gas; in fact, it had about quadrupled. This necessitated a considerable extension of the works. In 1870 they were enlarged, and additional land was purchased at a cost of £3000; and after that, in various years substantial amounts were laid out on the extension of plant and buildings. Besides the expenditure on the works, it was necessary every year, owing to the growth of Rhyl, to spend more money on the mains. The prices charged to the general consumers had ranged between 5s. 10d. per 1000 cubic feet when the Company started, to 5s. in 1871, 1872, and 1873, 5s. 7½d. in another year, and once it was 6s. 0½d. It was suggested by the Commissioners that the price was too high; but for the four years from 1887 to 1890 it had been 4s. per 1000 cubic feet. The Company had paid dividends beginning in 1870 at 5 per cent.; rising in 1880 to 9 per cent.; and in 1881 to 10 per cent.; in 1888 and 1889, it fell to 8½ per cent.; and in 1890 it rose again to 9 per cent. The Commissioners formulated their complaints first on Feb. 6, 1885, when a deputation waited upon the Directors of the Company, and expressed their dissatisfaction with the quality, price, and illuminating power of the gas; they also complained of the breaking up of the streets. It was explained to them that the Company had used the best materials possible for producing gas; and that, after ample purification, it was tested, and every failure reported. The Company were anxious to supply gas of good quality; and they were satisfied that they did so. As to the price, with the exception of one town, Rhyl was being supplied with gas more cheaply than any town similarly situated in the adjoining counties of Denbighshire and Carmarthenshire. The only exception was Wrexham, where they had a very much larger make of gas; and there the charge was consequently somewhat lower. Wrexham was also better situated as regards the coal-fields. The Company were willing that the gas should be tested at the works, and that the Chairman of the Commissioners should be shown over them at any time. It was also pointed out that it was impossible to supply people who wanted their houses lighted without first breaking up the streets; and that the Company always obtained the consent of the Commissioners before laying mains, as distinguished from service-pipes. Although there might possibly, by oversight, have been an occasional omission to do so, the requirement, as a rule, was complied with. It was always the wish of the Company to have the streets restored to their original condition; and they intimated to the Commissioners that they might do

the repairs themselves, and the Company would pay the costs, if this were more satisfactory. He was present at the inquiry before the Local Government Board Inspector in April last year, when the Clerk to the Commissioners said that their action in endeavouring to repeal the 34th section of the Act of 1852 was taken with the view of forcing the Company to seek parliamentary powers; he also said it was not proper that a Gas Company should exist in a town like Rhyl without having such powers. The Inspector, however, declined to sanction that part of the Provisional Order applied for. The Directors then, taking into consideration what had occurred before the Inspector, decided to apply to Parliament for statutory powers. They thought it would not be well to hesitate longer in endeavouring to obtain an Act, as, after what had passed, they looked upon the Commissioners as a hostile body.

Mr. BALFOUR BROWNE stated that the reason why the Local Government Board did not grant the Order asked for, was because they thought they had no power to do so.

Examination continued: The present was a convenient time to apply for an Act; because, owing to the growth of Rhyl, the Company required more capital, as further expenditure was necessary.

Mr. RIGG: Have the Commissioners ever communicated to the Company their willingness to purchase the gas undertaking?

*Witness:* No.

At this stage of the proceedings, the learned Counsel on both sides conferred together.

Mr. BALFOUR BROWNE: After the last question that was put—whether any formal offer to purchase had been made by the Commissioners—there seems to be a good chance of an arrangement being made; and if your Lordships will allow an adjournment to take place, it will perhaps not be necessary for me to cross-examine the witness at all, as I think there is every prospect of an understanding being come to between the parties.

Mr. RIGG: The Committee will perhaps accept my learned friend's suggestion. If you adjourn now, we might possibly utilize the interval profitably, and not trouble you at any great length.

Mr. BALFOUR BROWNE: If we went further into the matter here, we might get more distant from each other than we are now.

It was ultimately arranged that the Committee should meet again on the 19th.

### Friday, June 19.

On the re-assembling of the Committee to-day,

Mr. PRITT, the Parliamentary Agent for the promoters, brought up an agreement made on the 18th inst., between the Rhyl Improvement Commissioners of the one part and the Rhyl Gaslight and Coke Company, Limited, of the other part, which stated that, as the Commissioners had resolved that it was expedient, in the public interest, that the manufacture and supply of gas should be in their own hands, they had petitioned against the Bill of the Company, but that, as the result of negotiations entered into between the two bodies, it had been arranged that if, within twelve months from the passing of the Act, the Commissioners gave to the Company written notice, under seal, of their desire to purchase the gas undertaking, the Company should sell it to them, including all the plant, machinery, pipes, apparatus, meters, fixtures, and fittings at the works, with certain exceptions, together with the business of the Company, and the whole of their rights, powers and privileges, together with the benefit of all actions at the instance of the Company, and the benefit and liability of all contracts of sale and purchase, of service or employment, and of insurance, &c., and also all books, vouchers, and documents connected with the undertaking, from the date of the passing of the Act. It was further agreed that the price of the undertaking should be £32,000; the Company being allowed to retain the present reserve fund and all moneys in hand, to be dealt with and applied in the manner determined by the Company; that, until the transfer, the Company should continue to carry on and manage the undertaking at their own discretion, and for their own benefit, and should have a right to all the revenue and profits derived therefrom; that they should not spend a greater sum than £250 on new works, meters, or plant, during the first six months, after the passing of the Act, or an additional £250 during the next six months, without the sanction of the Commissioners, who should, on the transfer of the undertaking, repay to the Company any capital so expended—any difference to be settled by arbitration. It was also provided, amongst other things, that, upon the completion of the purchase, the Commissioners should pay a sum of £1400 towards the cost of the Company's application to Parliament; and there was a provision for a reduction in the price of gas by 3d. per 1000 cubic feet to consumers of upwards of 50,000 cubic feet per quarter.

The Committee having approved of the agreement read, and agreed to the preamble and clauses as amended, the Bill was ordered to be reported.

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**New Joint Stock Companies.**—The Andover Gas and Coke Company, Limited, has lately been registered, with a capital of £8000, in £10 shares, to carry on at Andover, in Hampshire, the business of a gas company in all its branches, as well as that of an electric light and power company. The Phosphate, Alkali, and Chlorine Company, Limited, has been registered with a capital of £45,000, in £10 shares, to acquire the undertaking of the Lancashire Alkali and Sulphur Company, Limited, and to carry on the business of chemical manufacturers.

**Rickmansworth and Uxbridge Valley Water Company.**—The ordinary general meeting of this Company was held last Friday, at the offices, Poultry, under the presidency of Mr. V. B. Tritton. In moving the adoption of the report, the Chairman stated that the works were taken over from the contractors as from the 8th ult. Nearly 37 miles of pipes had been laid; and there was a good supply of water, which was of excellent quality. The working expenses were now covered, and a small profit was being made. He believed that the Company would do an increasing business; and their parliamentary district was a large one. Mr. Berkeley Paget seconded the motion, which was adopted.

## THE METROPOLITAN WATER SUPPLY INQUIRY.

### Thirteenth Day—Thursday, June 4.

(*Before Sir* MATTHEW WHITE RIDLEY, *Chairman; Mr.* T. H. BOLTON, *Sir* ALGERNON BORTHWICK, *Mr.* BRISTOWE, *Mr.* H. W. LAWSON, *Mr.* J. W. LOWTHER, *Mr.* MURDOCH, *and Mr.* ROWNTREE.)

METROPOLIS WATER SUPPLY BILL.

On the resumption of the inquiry to-day,

Mr. *H. L. Cripps*, the Parliamentary Agent for the London County Council, was examined with reference to the position taken up by them in opposition to the Bill. He stated that he had obtained from thirteen of the large towns in the kingdom which owned water-works, information which led him to the conclusion that the municipal authority was a better body to have charge of the water supply than the Trust proposed in the Bill. This information witness laid before the Committee in great detail. The towns selected were Birmingham, Blackburn, Bolton, Bradford, Cardiff, Glasgow, Halifax, Huddersfield, Leeds, Manchester, Northampton, Oldham, and Sheffield; and the particulars furnished comprised the area of supply within and beyond the municipal limits, the names of the various local authorities having jurisdiction in the outside areas, and the prices charged for domestic and other supplies, with the discounts allowed, and numerous other details. He proceeded to say that none of the cases he had mentioned were so large as London, as was quite obvious; but the general principles involved were the same. He explained the differences between placing the water supply in the hands of a Trust, and having it under the control of the municipal authority; and said he could see no advantage that would be likely to result from the establishment of a Trust. The County Council had been so short a time in existence that they had not yet had an opportunity of dealing with the question; and they had been considerably crippled in their inquiries by the fact that they had no power to compel evidence to be given to them. He considered that authority should be granted to them to thoroughly investigate the matter, and that they should be empowered to bring in a Bill dealing with the subject; though he could hardly conceive that they could by any possibility propose a measure which would ensure acceptance in all its details. Witness submitted a number of resolutions and views expressed by local authorities in both the Metropolitan and the outside area, and said that, as far as he could see, all the outside authorities were adverse to the Vestries' Bill; while within the area there was by no means unanimity of opinion in its favour. He proceeded to state the position of the various Water Companies, and said that the Kent Company were differently situated to the others, as they were drawing their water from the chalk, which was a very valuable source; and the Company were in a position in many respects similar to that occupied by the various provincial water companies which had been purchased by the local authorities.

Mr. POPE said he did not think it was desirable for the witness to go into the history and peculiarities of the Water Companies. He should be quite prepared to concede that the County Council knew very little about the matter, and that it was desirable they should learn something more before they came to Parliament.

Mr. RICKARDS said he should agree that the circumstances of the Companies differed.

*Witness* then went on to refer to documentary evidence as to the condition of the Thames; and observed that the last report which had gone fully into the subject was that of the Rivers Pollution Commissioners in 1874. It was impossible to use stronger words of condemnation of the Thames as to the ultimate supply for London than were employed therein.

The CHAIRMAN said that he did not think the Committee were at all likely to give any additional powers to take water from the Thames; nor were any asked for.

*Witness* further stated that, in the case of Hertfordshire, the inhabitants had been suffering greatly from abstraction of water; and they might very properly say, when the London supply was under revision, that they ought to receive back some of the water which had been taken from them. As to the Lea, there were doubts as to the legality of the bargain which had been made between the Conservators and the Water Companies; but this was a difficult and complicated subject, and one which required further investigation.

In cross-examination by Mr. RIGG (for the Lambeth Water Company), witness said it had been brought to his notice that upon the Company's demand-notes for payment for water used for domestic purposes, there was a printed statement to the effect that the Master of the Rolls had decided that a garden supply was not a domestic supply; and on the strength of this, the Company had been in the habit of making a charge for water used for gardens. In one case the demand was resisted as illegal; and, after considerable correspondence, and a refusal to pay, the Company dropped their claim. His opinion was that it would turn out that there were a considerable number of persons who had been paying on an incorrect statement; and he thought it was very desirable that the case should be produced, in order to show really what was decided.

Mr. POPE said he did not think it was necessary for the Committee to settle what the law was.

Mr. RIGG: Do you know that the Lambeth Company charge less per house than the other Metropolitan Water Companies?

*Witness* said he did not; but before Parliament passed a Bill like the one before the Committee, which would make the past income of the Company a basis of arbitration, the legality of their charges would require to be carefully considered.

Cross-examined by Mr. POPE (for other Water Companies), witness said the reason Liverpool was not included in the statement he had submitted was that that town had lately been engaged in constructing a very large scheme of additional works; and the Town Clerk had informed him that they were in such a transitional state that he could not give a definite answer to the questions put to him. It was not correct, as had been assumed, that the reason why Liverpool was not included was because it would not be favourable to witness's assumption. There was a difference between the examples he had quoted and that of London in that the municipal corporations were the street

authorities, whereas the County Council were not. He was not aware of one single instance in which Parliament had handed over the water supply to a local authority without accompanying it with the condition of purchasing the existing undertakings; and he thought in all the cases agreements were entered into for the purchase. Every municipal body in the kingdom, except that of London, had the right to submit to Parliament schemes for dealing with the water question; and all the London County Council asked was to be placed in the same position as the others.

Mr. POPE said he was much inclined to agree with the witness, that legislation would be premature for the County Council, because they knew so little about the water question.

Mr. MOULTON protested against Mr. Pope's observation.

Mr. POPE said he was justified in making the remark, because the very ground upon which the case was based was that they knew so little about the matter, and wanted further time to investigate it thoroughly. (To Witness:) Is there any instance in which Parliament has sanctioned a competitive supply in the hands of a municipality.

*Witness*: No; but that is an entirely different thing.

Cross-examined by Mr. COWARD (for the Kent Water Company), witness said that the Company's advisers had met the County Council in a very friendly way, and given them every information. He was cross-examined at some length as to whether the Local Authorities were not perfectly satisfied with their relations to the Company, and had not in many cases applied to be placed under their supply; but witness generally stated that he was not aware of the circumstances. The case of the Kent Company would require consideration with regard to the quantity of water that was available in their district for the supply of the extra-Metropolitan area and the intra-Metropolitan area, and whether there was enough to leave any surplus; but these were, he said, engineering matters upon which he was not competent to speak. In dealing with the question, they would have to consider the extent of the area supplied, the vicinity of population, the natural facilities of the water supply, and the altitudes of the services. In the case of Glasgow, they were in close proximity to a natural lake—Loch Katrine—which afforded a gravitation supply. He would be very much surprised if it was the fact that, with the exception of Glasgow, in the case of every one of the Municipalities he had quoted, the charge for water was much higher than the Kent Company's rate; but he had not gone into the matter himself.

*Witness* was then cross-examined by Mr. RICKARDS, on behalf of the promoters, as to the relative amount of support that was given to the action of the County Council and to that of the Vestries.

The CHAIRMAN stated that the Committee were clearly of opinion that the Bill was *bonâ fide* brought forward by those Vestries which had been named by the promoters; and they heard the statement, which was not disputed, that 23 of them had subscribed to the expenses attending its promotion. This was quite sufficient evidence that they approved of the Bill in whatever form it was.

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**Fourteenth Day—Tuesday, June 9.**

Mr. *Cripps* was recalled this morning, and further cross-examined by Mr. RICKARDS with reference to precedents for the compulsory purchase of water undertakings upon arbitration terms. He reiterated that he did not know of any case in which a corporation, when entrusted by Parliament with the duty of controlling the water supply of their district, had been allowed to set up a system without purchasing the existing works. With reference to the amount of support given by the Local Authorities to the policy of the County Council, he thought it was very likely to be the fact that, out of the 57 petitions against the Bill, 36 of them objected in terms to that part of it which, as an alternative, constituted the County Council the Water Authority.

Re-examined by Mr. MOULTON, the witness said that, taking one of the main points of difference between the policy of the County Council and the Bill—that the supply of the large outside area should be in the hands of a central Trust—he doubted if this particular proposition had been adequately considered and thought out by any of the Vestries. He did not for a moment suppose that the Vestries and District Boards were anxious that the County Council should supply that area, or that a Board should be formed for the purpose if the supply of London could be efficiently conducted otherwise. He fancied that generally the principle of placing the water supply in the hands of the municipal authorities was the one that commended itself to them. With reference to precedents for compulsory purchase, he mentioned the case of Stockton and Middlesbrough, in which the Company concerned were requested by the Local Authorities to go farther afield for a new supply. This the Company refused to do, and introduced a Bill authorizing them to get an additional supply from the same locality. The Corporations then promoted a Bill empowering them to obtain a supply farther away; and they included in their Bill the compulsory purchase of the Company's works. This was a case of competition combined with purchase. It was strongly resisted; but the Committee passed the Bill in the Lower House, and invited the Company to stop and settle the terms on which their undertaking should be transferred. The Company, however, said they would prefer the chance of opposing the Bill in the Upper House. The Committee then themselves formulated clauses setting out the principles upon which the transfer should take place; and they passed them in the absence of the representatives of the Company. The Bill went up to the House of Lords, and the Company again opposed it vigorously; but it was confirmed, and then, at the last moment, the Company took part in the discussion on clauses, with a view of making it as beneficial o themselves as they could. Both of these Committees were as iberal to the Company as they could possibly be. This was obviously a case which might be analogous to London, assuming that, on investigation, a considerable number of Londoners thought a new supply was advisable, that the Water Companies refused to go for it, and that a Bill was introduced by a municipal body for an independent supply.

Mr. MOULTON: Has the County Council, as the law at present stands, power to bring such a Bill forward?

*Witness*: No. It depends upon a legal question as to the interpretation of section 144 of the Act of 1855; and there is a certain amount of difference of opinion about it.

Mr. RICKARDS said the Queen's Bench Division had settled it; and the decision had not been appealed against.

*Witness* said his proposition was that the County Council should be put in the same position as the Stockton and Middlesbrough Corporations; that all doubts as to their power to initiate legislation should be removed; and that they should be put in a position to bring in a Bill.

Sir *T. Farrer* was then recalled to complete his evidence. In further cross-examination by Mr. RICKARDS, he said no doubt eventually the Water Authority for London would have to acquire the undertakings of the Water Companies. He agreed with Mr. Wilkins's figures as to the increased market value of the stock of the Companies in proportion to the capital issued; but to say the value of the stock was the amount which must be given for the undertakings was a different thing.

Mr. RICKARDS: We do not propose to take the market value as a basis of what the Arbitrators should give.

*Witness* remarked that he was very glad to hear it.

Do you know that the words we have employed in our amended clause, as to the directions to be given to the Arbitrators, were taken from a suggestion of your Chairman in the House of Commons on the 20th of March last?—No; I do not know where you got them from.

Mr. RICKARDS then read from the proceedings of the House on the instruction moved by Mr. Ritchie, in which Sir John Lubbock asked whether, under the instruction as framed, the Committee would be able to inquire into the efficiency, condition, and value of the Companies' works; and, if not, whether he would introduce words to this effect. He asked the witness if there was not a strong family likeness between these words and those put into the amended clause of the Bill.

*Witness* said it was a very different thing to suggest that this Committee should have the power to inquire into these large subjects, and to put a clause into the Bill to say that the Arbitrators should fix the value according to the result of those inquiries. He did not think Mr. Rickards could quote Sir John Lubbock as the authority for his Bill.

Do you not think it right that the Arbitrators, in assessing the value of an undertaking, should have regard to the adequacy, as respects both quality and quantity, of the water supplied hitherto, and the sources from which the particular Company take their water?—If the word "Arbitrators" is left out, my whole evidence goes to show that it is a most important question to be considered.

You think it would be very proper—and I do not disagree with you at all—to have regard to such consideration itself. Do you consider, when it comes before the Arbitrators, that they should assess the compensation to be paid for a water undertaking without having regard to the sources of supply and the adequacy of them?—I have never said that.

Do you think it is proper that an Arbitrator should omit from his calculation the question of whether the works were in proper condition?—If he omitted it, his award would not be worth the paper upon which it was written. I think no Arbitrator could take into consideration the necessity, and what would be the cost, of a new supply to London; and this is the question which has to be determined before the Arbitrators could decide what ought to be given for the works of the Water Companies.

Do not imagine that I suggest that the Arbitrator should decide the source whence the new water should be taken. What I suggest is that he should take into consideration whether a company whose undertaking is going to be acquired has sufficient water to draw upon for the immediate future, or whether they will have to expend a large amount of fresh capital and go to fresh sources?—And, if so, what amount.

Do you suggest that the House of Commons should assess the amount of compensation payable to a water company in respect of their undertaking?—I cannot tell you how I should assess it, because we have not yet arrived at that point.

Cannot you give me some idea? Is it for Parliament or for the Arbitrators to assess the value of the undertaking?—I think it is for Parliament to lay down the terms upon which the Arbitrators should assess the value.

I ask you, upon that, do you object to these terms?—Yes; I do. I do not think any Arbitrator could act upon them.

Then I must take the other alternative. Do you think a Committee of Parliament could assess the value?—It is not for me to draw your Bill. We have no Bill for the purchase of the water undertakings, and when we have one, we should be prepared to defend its terms. It does not rest with me to amend your Bill.

I am in this position: You are criticizing my Bill, and I want to criticize your scheme?—We have no scheme; and the very essence of our evidence is that we are not yet ripe for a scheme. The first thing is to get rid of yours.

And for that purpose you have shaken hands with the Corporation of London, who have brought in a Bill of their own which is in opposition to your Bill?—We have no Bill.

But you have a Bill which has passed the first reading?—Yes; but it only puts us in the position of being able to bring in a Bill.

I think the County Council lodged a petition against the Corporation Bill?—Yes; because we do not like that large constituency which they propose. Besides, the Corporation have given it up themselves.

You do not quite agree with the Corporation as to the point of view from which you are to approach this subject of the purchase of the water undertakings?—I do not think there has been any great division of opinion between us on that subject.

The Corporation, who held an inquiry last year, in their report state that "the first question has been for the consumers to become emancipated from the control of private capitalists having vested interests, and for the supply to be placed in the hands of a public authority." You think that is the second question, do you not?—I think so; but I am pretty sure their Bill provided that the body they proposed to constitute should have power to bring in Bills; whereas your Bill does not.

Their Bill was for the constitution of a Water Trust, representing the whole area; and their report was to the effect that the first question (speaking, I am bound to tell you, of Manchester and Glasgow) has been for the consumers in these two cases to become emancipated from the control of private capitalists having vested interests—those are the Water Companies?—I think you would put the thing more fairly before the Committee if you took the present views of the County

Council and the City. The views of the Council have not been the same throughout. It is a very difficult and complicated question. I do not hesitate to say that I have changed my own opinions since I first began to look at it; and many other persons have changed theirs.

I see that in the Commissioners' report they say: "It is manifest that no one of the many County Councils whose jurisdictions are marked on this map, nor the London County Council, nor your honourable Court, can expect Parliament to entrust it individually with the government of so large an area as that indicated on the map." This applies to the whole watersheds of the Thames and the Lea. That was adverse to the County Council getting the supply into their own hands. Now, are we agreed that, with regard to the outside authorities, the circumstances vary enormously?—Very much indeed. It would require a great deal of inquiry, discussion, and negotiation before a proper and complete plan of dealing with them could be arrived at.

Would it not require a little practical experience, too?—Yes; that is a difficulty on the part of the County Council and the City, and a still greater one on the part of such a Trust as you propose to constitute, because they would be an entirely new and loosely-organized body, and the County Council and the City have been learning to act together.

In the last ten days, may I say?—Each body is organized; and having been in the habit of acting together on their own respective bodies, they would do it with ease as compared with your new heterogeneous Trust.

Do not use hard words. The first thing to be done is to get rid of the common enemy and oppressor of all, the Vestries' Bill?—That is a fact.

Do you not think a little practical experience on behalf of the County Council would be necessary before you could determine what portion of the undertakings you could sell to the Local Authorities outside, and what you could not?—It is possible that, in some cases, it would be better to make an arrangement at once, and in other cases it might be better to postpone it.

Exactly. It might be just possible, I admit, to let the Local Authorities outside take over the supply. The sources are at a considerable distance from the works?—Yes.

And therefore if a local authority acquired the works in their own district, they would take over the pumping works and reservoirs that are useful for the whole of London?—That would be a question that would have to be considered.

Do you think it would be possible to find that out fully without first carrying on the undertaking?—That is a question I would rather you would ask the Engineer.

It is an important question for my Bill. My proposition is that the Water Trust should buy the undertakings first, and afterwards sell what they do not want to the Local Authorities, on terms to be arranged between them?—That is a new feature with regard to your Bill. As I understand your Bill, you may supply the whole district, and may levy rates over it.

That is so. The proposition of the Bill is that the Trust shall acquire the whole of the undertakings; but there is a very important clause—clause 47—to which I might call your attention, which provides that the Trust may sell, by public auction or by private contract, either unconditionally, or subject to such conditions of sale as they may think expedient, any of the works, buildings, land, plant, and material which they may acquire; carrying the moneys to a sinking fund or applying them to the purposes of the Act to which capital is properly applicable?—That has absolutely nothing to do with selling part of the undertaking to a local authority to supply water in their district.

You will pardon me for saying that that clause might be very easily modified, giving a right of pre-emption to the Local Authorities outside?—If you introduce new things into your Bill.

It is a definite scheme at the present moment, which is more than you can present for the County Council. However, I see, apart from this, that among your criticisms of our Bill you say that a large new independent governing body will be elected by a different constituency from a different area. Do you know who are to be the constituents in the case of the Trust?—They are the water ratepayers of this area.

No; they are the county electors?—I beg your pardon, I am wrong.

You object to the Companies, when they come before the Arbitrators, availing themselves of the Quinquennial Re-valuation Act of 1869?—Yes; I think the effect of the quinquennial re-valuation—that when the valuations rise, the water-rates rise with them—was not sufficiently considered at the time the Bill was passed.

Would you prefer that this should not be taken as an element of compensation to the Water Companies?—I think so, most decidedly, supposing there was an arbitration, the Arbitrators should take into consideration the possibility of Parliament altering that.

Suppose a central authority buy up the undertakings of the water companies and resell afterwards to the Local Authorities, do you not think it would be advisable that the authorities should be represented on the purchasing body in the first instance?—No, I do not.

Let us take an example. Suppose the County Council buy up the works of the Kent Water Company, a large portion of the Company's area being outside the Metropolis. Your proposal is that the Local Authorities should buy up the portion outside the Metropolis?—If they desire it; but they are not to take away the supply that properly belongs to London.

The Local Authorities in Kent are the ultimate purchasers, therefore, of the water undertaking of the Kent Company, or portions of it?—Certain portions of it. We will assume that to be the case.

But the County Council in the first instance would conduct the purchase?—And would, of course, come under the obligations under which the Company now lie to supply that district with water.

Do you not think it would be fair that the Kent authorities should be represented on the purchasing body?—No; I do not think it is at all necessary.

Should they not have something to say as to the terms upon which the Kent Company's works are purchased?—No; I do not think so.

Supposing you came to sell to the Kent authorities subsequently, would you expect them to adopt as correct the amount you had agreed to give for the Kent Company's works?—I have said that all these arrangements will require a great deal of care and consideration in carrying out; but, if I may make assumptions, let me assume that a district authority down in Kent wish to buy, the probability is that in the Bill conferring upon the County Council the power to buy the water undertakings, a clause would be inserted enabling that body to buy from the Council on certain terms, which would have to be carefully settled. I put that as a suggestion.

Then the original Bill would contain terms of purchase from the Council for all the outside authorities?—Not necessarily; only in those cases where they desire it.

You think that, before the introduction of such a Bill, the Council could, and would, decide what they could sell and what they could retain outside London?—There would be an infinity of negotiations.

Could you put a date upon the Bill?—No; because we have not reached that difficult initial question of the source of supply. That is the real hitch in all these negotiations.

It is inevitable that you must buy out the Water Companies?—Yes.

And the value of the undertakings is increasing every year?—Yes; but the Companies have been dividing profits up to the hilt. They have not been providing any reserve for future supply; and the necessity for it must come upon them soon, and will cost between £10,000,000 and £20,000,000. Parliament must take care that the expense of that new supply falls upon their shoulders; and, taking this into account, I think very probably you will see the proper figure to put upon their market value.

There I am entirely with you. But the question I want you to consider now is whether you should not follow, as in all other cases that I know of, the precedent established by Parliament—first clear away private interests, and then extend your supply.—I have told the Committee already that I would have nothing to do with precedents, because I know how deceptive they are. It would take from three to four days to get the facts of any one of those precedents, and three or four hours to explain them to the Committee.

With regard to finance, supposing a Water Trust were constituted, do you suggest that one of the objections would be that they could not raise the money as well as the County Council?—I should doubt whether a body of that kind, raising it on a new security, would be able to raise it so well as a body which has nearly £20,000,000 of stock in the market, and which raises it on very low terms indeed.

You admit that the securities are good ones?—Yes, the securities are very good; but people like a well-known stock.

Would the objection be met if the County Council were to borrow the money for the Water Trust, and lend it to them as they do to the School Board?—I think we should prefer to borrow it for ourselves.

I have no doubt you would. Is it your opinion that the Water Companies spend new capital in repairs and renewals?—It is very difficult to tell or to distinguish between repairs and renewals and extensions for the purpose of new supply. I doubt very much whether it is possible to make a distinction.

Mr. Stoneham is a very competent Auditor, and it is part of his duty to see that the capital of the Companies is not expended for renewal purposes?—The distinction is one of the most difficult questions anyone can have to do with. No doubt he deals with it to the best of his ability; and, so far as he can help it, he does not allow the expenditure of capital upon repairs and renewals.

In further cross-examination, witness said he was of opinion that a central authority would manage matters much more economically than the Water Companies, and that therefore there would be a larger amount of profit, which would be applied partly in reduction of the water-rates, and partly in paying off the capital by means of a sinking fund. But it must be remembered that, if the authority were to acquire the undertakings, they would have to face the awful question of a new supply; and they would also have to face a sinking fund, which the Companies had not provided for. His whole contention was that, if the Companies had acted wisely, they would, instead of paying such large dividends to the shareholders, have put aside money for the new supply. Whether the new authority were the County Council or the Water Trust, they would have to meet that, and therefore would not be able to share such large profits as the Companies had done lately.

Mr. BRISTOWE said he supposed it had struck the witness that, if there was a new supply, there would be additional revenue.

*Witness* said that, in all the estimates which had been made by the late Mr. Smith and others, they had always reckoned on an increase of revenue, without calculating the enormous additional expenditure to which they would have to go.

Mr. BRISTOWE: But it struck me that you were going in the opposite direction, and were reckoning on an increased expenditure without considering increased revenue.

*Witness:* Oh, no; the Companies have been acting, and Lord Cross acted, upon the notion of a constant additional revenue arising from increased water-rents, and did not take into consideration the enormous expense that would have to be incurred to secure that increase.

In re-examination by Mr. MOULTON, witness said that Mr. Pember had promised to furnish a full statement of the Companies' dividends; but he desired to suggest that no return of profits or dividends would satisfactorily show what the profits were that had recently been realized, unless there was added to it the profits the Companies had made from time to time on new capital before the introduction of the auction clauses.

Mr. *A. R. Binnie*, M. Inst. C. E., Engineer to the County Council, was then examined by Mr. FREEMAN. He said he had had very considerable experience in connection with municipal water-works, as carried on by the Corporations of Glasgow, Manchester, Belfast, Leeds, and Bradford. He had constructed large water-works in India; and for 15 years had been the Water-Works Engineer for the Corporation of Bradford. For the last 25 years he had taken the greatest interest in the water question in reference to London; and he was engaged, under the late Mr. Bateman, in preparing the details which led up to the proposal which he brought before the Duke of Richmond's Commission in 1869. He produced information which he had gathered from almost every town in England, giving particulars as to water supplied by constant pressure, by wells, by gravitation, or by other means. He desired to supplement the table put in by Sir T. Farrer, as to the amount of water taken from the Lea, by stating that the total

of 72,000,000 gallons included what was drawn from wells in the Lea Valley as well as from the open river. In 1888, 57,500,000 gallons of water were taken from the river, and 10,400,000 gallons from wells; in 1889, 58,200,000 gallons from the river, and 11,693,000 gallons from wells and springs; and in 1890, 59,628,000 gallons from the river, and 13,232,000 gallons from wells. These figures showed that the drawings from the river had steadily increased. With regard to the County Council undertaking the water supply, it had many analogous duties—such as sanitary regulations, main drainage, and extinction of fire; and he did not see any difficulty in their adding the water supply. He considered that the Bill of the Vestries was unnecessary, and would lead to great expense and complications. He detailed the circumstances connected with the acquisition of the water-works at Glasgow and Bradford; and he said that if the companies and corporations were left, they ultimately came to an arrangement which Parliament sanctioned, and then an Act was passed containing power to purchase and sell, which many people were apt to confuse with compulsory purchase. One of the main reasons for such an authority as that proposed by the County Council and the Corporation being constituted was to ensure the health of the Metropolis; and he considered that it was the great scandal of the age that there was nobody in London to represent the public on this great question. He believed that, if power were given to them, they would within two years be able to bring in a Bill dealing with the subject. Neither he nor the Council desired to suggest that the Companies should be treated unfairly; and he hoped that if an authority were constituted, on the basis proposed by the Corporation and the Council, they would come to terms with the Companies, as had been done in various other parts of the country. Supposing terms could not be arranged, then arbitration must be resorted to; but Parliament should lay down very strictly the lines that should guide the arbitrators in fixing the value. There was considerable uncertainty, as far as he could make out, as to how far the alleged rights of the Companies to use the Thames water were sanctioned by Parliament; and the result of the large abstraction of water from the Thames had been to decrease the flow through the Metropolis. He considered this to be dangerous, inasmuch as the water was returned into the Thames lower down, at Woolwich, in the shape of clarified sewage, which was constantly passing up and down the stream. The pumping from the wells in the Lea Valley had had an injurious effect upon the flow of the river. That water was obtained from the chalk; and it was the purest supplied to London.

The Committee then adjourned till the following day.

**The Threatened Litigation over the Stainland Water Scheme.**—It is understood that notice has been given by the plaintiff in the action of *Crabtree v. The Stainland Local Board*—the object of which was to restrain the Board from constructing water-works at Coldacre (*ante*, p. 556)—that he will not proceed any further with the action.

**Large Water Scheme in California.**—A big water supply scheme is on foot in California, promoted by the Blue Lakes Water Company, recently reorganized. The new Company has a nominal capital stock of $10,000,000, half of which has been subscribed, and $300,000 paid in. It is reported that the Company propose to lay a steel conduit 170 miles long and 6 feet in diameter for some distance at least, from Blue Lakes, to supply water to Oakland, Sacramento, Stockton, San José, and other cities and towns.

**Sales of Shares.**—Six hundred new ordinary shares in the *Kettering Water-Works Company* (part of the additional capital authorized to be raised for the purposes of new works now in course of construction) were recently sold by auction at an average price per share of £11 2s. The sale realized a total of £6642. At the Auction Mart, Tokenhouse Yard, last Wednesday, Messrs. Edwin Fox and Bousfield sold by auction nearly one-half of a King's share in the *New River Company* at the rate of £84,410 for an entire share; a portion of an Adventurer's share, at the rate of £53,200 per whole share; and two new £100 (fully paid) shares in the same Company, which realized £370 each.——Last Wednesday, 157 shares of various classes in the *Windsor and Eton Gas Company* were sold by public auction at Windsor. For original shares, the prices realized were £42 15s. and £42 10s.; for preference shares, £10 10s.; for new shares, £30 5s.; and for new shares with £8 paid up, from £11 10s. to £12 2s. 6d.—the total produced by the sale being £2663.

**East Surrey Water Company.**—The annual general meeting of this Company was held at Redhill on the 13th inst.—Mr. E. Easton in the chair. The Manager and Secretary (Mr. J. R. Downes) having read the notice convening the meeting, the report of the Directors was presented. It stated that the 2400 shares of which the issue was sanctioned at an extraordinary general meeting held on Jan. 31 last had been allotted; applications for more than 3000 having been received. The profit and loss account showed a balance of £3324 15s. 5d., out of which the Board had placed £500 to the credit of the renewal and contingency fund, and recommended that the dividends upon the preference shares should be paid and that a dividend of 4 per cent. be declared upon the ordinary shares; leaving a sum of £247 11s. 11d. to be carried forward. The Chairman moved the adoption of the report, and read a report by himself and Sir F. Bramwell upon the new works at Kenley. It stated that a quantity of not less than 1¼ million gallons of water per day of 20 hours' working could be obtained from this source. The new softening reservoir, to hold 220,000 gallons, was approaching completion; the new main from Kenley towards Redhill had been laid, and proved under pressure for about four-fifths of its length. At Caterham the new gas-engine and pumps had been at work for some months. The report was adopted. A discussion then took place on the subject of the Directors' remuneration, which it was proposed to increase by £50 per annum; but Sir F. Bramwell stated that the unanimous feeling of the Board was that there should be no advance until there was an increase in the dividend paid to the shareholders. The retiring Directors (Sir F. Bramwell and Colonel Searle) and the retiring Auditor (Mr. J. W. Weldon) were re-elected; and the meeting terminated with a cordial vote of thanks to the Chairman and Directors.

# MISCELLANEOUS NEWS.

## WIDNES LOCAL BOARD GAS AND WATER SUPPLY.

### Loss on the Gas-Works—The Value of the Dinsmore Process.

At the last Meeting of the Widnes Local Board, the accounts of the gas and water undertakings for the year ending in March last were presented. The gas account (which included an item of extraordinary expenditure, amounting to £2630, for a new purifying-house and for damage done by the flood which occurred at the works in November last) showed a loss of £292; the water account a profit of £1747. In submitting the minutes of the Gas and Water Committee containing these accounts, the Chairman (Mr. B. Brown) called special attention to them. Referring to the loss on the gas-works, he explained that during the past year they had been working with a lower-priced coal; and although they did not get so high a yield of gas per ton as they had had in previous years, they obtained a larger quantity of residuals. In this way they had received great assistance from the Dinsmore process; 25 or 30 per cent. of their retorts now being worked by that system. Perhaps members would recollect that some time ago certain of the retorts did not work well. This, however, was merely a matter of setting, and had since been remedied. The increased revenue from residuals had been considerable. They had received £800 or £900 more from coke, and about £200 more from tar, than in previous years; so that they thought it was advisable to continue this policy of using an inferior kind of coal, and, by the aid of the Dinsmore process, obtain a larger quantity of coke, tar, and sulphate of ammonia. During the year they had incurred some special expenditure, and had suffered great damage owing to the flooding of the gas-works. On that occasion considerable loss was incurred in consequence of the work being badly done through the retorts being wet. He thought the members would admit that, under the circumstances, the balance-sheet was a very good one, especially considering that the price the Board charged for the gas was so very low. Better profits were made than those realized at Widnes; but if the Board charged the same price for gas as was paid in a neighbouring town, they would have made a profit of about £4000. By the water-works they had a profit of £1747, notwithstanding that the expense of pumping had been very greatly increased; the cost of fuel having been about £800 more than in the previous year. They had also suffered somewhat from leakage, which they had, however, partially overcome. The results altogether were very favourable. He moved the confirmation of the minutes. Mr. Wright seconded the motion; and it was carried.

## BATLEY CORPORATION GAS SUPPLY.

### Reduction in Price.

At the last Meeting of the Batley Town Council, the minutes presented by the Gas Committee contained a recommendation that, from the 1st of October next, the price of gas to private consumers should be reduced by 5d. per 1000 cubic feet—viz., from 3s. to 2s. 7d.—throughout the whole district of supply. Alderman Brooke, in moving the confirmation of the minutes, remarked that it had for many years been the practice to charge all the gas-works expenditure to revenue, and at the end of the half year or nine months to take out the amounts which really belonged to capital, and place them to the capital account. The Gas Committee had decided to continue the £1600 they had hitherto handed over to the contingency fund, and to put all real capital charges to the capital account. For the nine months ending March 25, the Committee had resolved to pass £1200 from the profit and loss account. With regard to the reduction of 5d. per 1000 cubic feet in the price of gas, he thought all would be prepared to approve of it. He believed he was right in saying that in 1883 and 1884 gas was sold in Batley at 2s. 7d. per 1000 cubic feet. It was in 1882 that the Corporation agreed to lower the price—very largely, no doubt, in consequence of the electric lighting scare during that year, and also with a view to increase the consumption of gas. In 1883-4 they lost money by the reduction; and they were just this 5d. per 1000 cubic feet short of making the gas undertaking pay. In 1883 the total consumption amounted to 86 million cubic feet; in 1890, it had risen to 128 millions. After incidentally mentioning that the Corporation had been helped considerably by the fact that loans falling due had been re-borrowed at a somewhat lower rate of interest, Alderman Brooke gave a word of praise to Mr. T. Holgate, the former Manager of the works; and stated that his successor—Mr. J. F. Bromley—was doing very good service. The works were carefully and economically managed in every way. The Committee were now paying 3s. per ton more for coal than they did a few years ago; and, under these circumstances, the proposed reduction spoke well for the management and everything connected with the Gas Department. The profits had been very good during the last few years; and the Committee had no hesitation in saying that, supposing coal did not go up in price, and that they could sell their residuals on the present terms, and provided the consumption increased, there would be a profit of £7000 a year, after adding to the sinking fund and paying interest. A reduction of 5d. per 1000 cubic feet would absorb about £2600; and he thought it was right that those who consumed the gas should benefit by it. The Committee intended to continue the contribution of £2000 a year to the borough fund; and with the £1000 to be paid to the contingency fund, reckoning also the £2600 off the £7000 profits, there would remain a balance of £800 or £1000. Their capital and plant now stood at the sum of £126,400; and he wished to point out that this belonged to the ratepayers, whether they were gas consumers or not. They ought all, therefore, to stand by the gas-works as long as they could. By this he meant that no ratepayer, or body of ratepayers, should endeavour to thrust the electric light upon the town, until it had been proved, without a shadow of doubt, in other places that it would be to the advantage of the town to adopt it. Mr. Illingworth thought the gas-works, as a whole, had proved a success. He said he was in favour of keeping the capital account down, and wiping

off the money as fast as possible; at the same time he expressed his disapproval of handing over £2000 yearly to the borough fund in relief of the rates—preferring that it should go towards reducing the water-rate. The minutes were confirmed.

## DUNDEE GAS COMMISSION.

### Annual Accounts.

At the Annual Meeting of the Dundee Gas Commission last Wednesday—Ex-Provost BROWNLEE in the chair—the accounts for the year ending April 30 last were presented.

Mr. J. MITCHELL, the Convener of the Finance Committee, said that the past year had been one of considerable anxiety, not only to gas makers in Scotland, but to a great many who had to depend upon a regular and large supply of coal. The unfortunate and prolonged railway strike, occurring as it did at the busiest time of the year, put the management very much about, and forced them to use coal other than that contracted for, and at prices which went a long way in disturbing the estimate framed a year ago. In addition to this, the production of gas per ton of coal carbonized fell considerably short of the quantity estimated, which, of course, necessitated an increased consumption of coal. Instead of obtaining 10,200 cubic feet of gas per ton, the yield was only 9631 feet. This deficiency arose to a considerable extent from the class of coal which they were compelled to take during the strike; as also from the absolute necessity imposed upon their Manager (Mr. J. M'Crae) to put into use an antiquated and virtually condemned bench of retorts, which had not been in use for some time, and which were found to be leaky. Commencing the year with the small debit balance of £73, it was estimated that the make of gas during the twelvemonth would be 430 million cubic feet, and that to produce this £42,157 tons of coals would be required, and which were contracted for at the average price of 17s. 5¼d., or, with the wages of firemen and the cost of haulage and breaking, 21s. per ton. This cost was exceeded to the extent of 7¾d. per ton for coal, and in wages by 3¼d. per ton, or altogether 10¾d., which on the quantity of coal carbonized—viz., 48,774 tons—represented the sum of £2184. The past year was one of exceptional demand for gas. The quantity of coal used was 48,774 tons, or 6617 tons in excess of the estimate; and the amount of gas made was 470,381,700 cubic feet, or 40,381,700 feet above the estimated quantity. Of this production, 420,152,750 feet were sold, 5,439,050 were consumed at the works, and 44,789,900 feet remained unaccounted for from leakages and other causes. From the sale of gas and meter-rents, the revenue was £76,487, or £4644 more than the sum estimated. The chemical products, which last year were disposed of at the rate of 3s. 6d. per ton of coal carbonized, produced £8558, or £1180 over the estimate; and from coke they derived £2123, or £1323 more than the estimate. The total revenue from all sources came to £87,496; being £7035 above the amount estimated. Under the various headings of expenditure other than that for coals, some showed an increase, while others had worked out considerably below the estimate. The total outlay for the year was £89,877; so that there was a balance against them at the end of the year of £2381, which, taking everything into account, could not be considered a very bad result of the year's working. They had availed themselves of their borrowing powers under the various Acts to the extent of £181,247; leaving £18,753 still available. During the past year, the small sum of £1478 had been charged to capital account; and it was not expected that this sum would be exceeded during the current year. At the beginning of the financial year, they had at the credit of the sinking fund the sum of £39,100, to which was added at the end of the year £7500, being the amount authorized by their various Acts, and also the sum of £710 for interest—making in all £47,310. Out of this they had redeemed mortgages amounting to £20,000, and annuities £162, which cost £4960. This left a balance in the bank of £22,350. About ten years ago the annuities could have been obtained at 25 years' purchase; now they could not be had under 30 years' purchase. This enhanced value greatly increased their indebtedness, the additional five years' purchase representing no less a sum than £37,835. The sinking fund of £7500 could not, therefore, in view of their obligations, be considered too heavy an annual contribution from revenue. Although they commenced this year with a debit balance of £2381, an estimate had been made out which provided for a supply of gas of about 25-candle power without any increase in price, and from which they expected not only to extinguish this balance, but, after providing for some extraordinary expenditure, to finish the year with a credit balance of £329. They put the total estimated expenditure down at £90,879; and the revenue at £91,208. He concluded by moving that the price of gas be fixed at the same rates as last year—from 3s. 8d. per 1000 cubic feet in Dundee to 4s. 11d. in Downfield.

Mr. ROBERTSON, in seconding the motion, expressed the hope that the contingent fund might be raised to £15,000 or £20,000. He also pointed out that they had still annuities to the amount of £7567 to redeem; and that at the rate they now had to pay for them, this would require £227,000, to meet which they had only a sinking fund of £22,350, with an annual payment to it of about £8000.

The motion was adopted.

**Forged Debentures of a Gas Company.**—The Lord Chief Justice recently had before him and a special jury the case of *Gilletts v. The Havant Gas Company*. It was an issue sent from the Chancery Division, and it raised a question whether the signatures to certain debenture bonds of the Company were forgeries, and whether the seal of the Company had been properly attached to them. The matter was before the Appeal Court in October last year, and was mentioned in the JOURNAL at the time. The plaintiffs, a firm of bankers at Whitney, had advanced money on the bonds to one of the former Secretaries of the Company, who had absconded; and their case was that the bonds were genuine. The jury found that the signatures were forgeries, and that the seal of the Company had been improperly attached. His Lordship therefore gave judgment for the defendants, with costs.

## BELGRANO (BUENOS AYRES) GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held yesterday week, at Winchester House, Old Broad Street—Mr. F. A. HANKEY, M.P., in the chair.

The SECRETARY (Mr. H. M. Gerrard) read the notice calling the meeting; and it was agreed to take as read the report of the Directors for the year ending Dec. 31, which was referred to in the JOURNAL last week (p. 1202).

The CHAIRMAN said the Directors greatly regretted their inability to present a more satisfactory report and statement of accounts; but he thought a consideration of the state of affairs that had prevailed for some time in Belgrano—notably in the past year—would show them that the circumstances had been such that no forethought or care on the part of the Board would have rendered it possible for them to cope successfully with those financial difficulties which had of late beset all commercial enterprises in Buenos Ayres. Looking at their undertaking as a manufacturing concern, he thought the shareholders would be satisfied. With reference to the yield of gas, they had during the past year produced no less than 11,517 cubic feet of gas per ton of coal. As regarded leakage, in 1888 it stood at 12¼ per cent.; in 1889, at 11¾ per cent.; and in the past year, at only 10 per cent. This decrease had been effected notwithstanding the fact that more than 40 miles of new mains had been laid during the three years. The private consumers had increased by 976; the total number being now 4330, with a grand total of 21,552 lights. In regard to the street lighting, the number of lamps had increased from 1860 to 2719. The value of the gas supplied had also increased from $350,620 to $531,144, showing an increase of about 50 per cent. They had been enabled somewhat to increase the price charged for gas in the past year; but this advantage had been quite nullified by the increase in the cost of coal. In 1889, they charged a fraction over $4 per 1000 cubic feet; while in 1890 they charged rather more than $4¼. On the whole, he thought they might say that their concern, as a gas-making undertaking, had succeeded; but the high price of gold had entirely nullified this great advantage. Passing to the balance-sheet, he drew attention to the salient features of it; pointing out that the creation of the exchange suspense account (£42,117) had been due to the obligation under which they had found themselves to guard against possible depreciation of their liquid assets in Buenos Ayres, in consequence of the enormous gold premium now existing. What he termed "liquid assets" were the items on the other side of the balance-sheet of debtors in Belgrano, amounting to £33,817, Municipal bonds at Belgrano, and the bills receivable and cash there. These items roughly amounted to £76,000; or, after deducting the cash in London, £72,000, with respect to which they had to take precautionary measures, owing to the high premium on gold. The shareholders might ask the Directors how they had arrived at the item of £42,117. In the first place, there was an amount of £12,658, which came from the exchange suspense account in the last year's balance-sheet. They then had an amount of £21,741, which had been carried to the debit of profit and loss, in consequence of the necessity of providing for the depreciation of their assets in Buenos Ayres. Then they had a total of £10,788, which was made up of the reserve fund of last year. From these totals, which amounted in the aggregate to £45,187, they had to deduct £3071, which was a loss they had incurred in Belgrano by the necessity for converting into gold some paper money which they had taken from debtors. Having mentioned that they expended £33,802 in 1890 on new works, extensions, &c., the Chairman stated that the gross receipts for the year had been £147,527; and the cost of manufacture and the expenses in Buenos Ayres, £92,000. The amount credited to capital expenditure account was £23,249, representing the gold premium on expenditure in Buenos Ayres, which had been written off by the Auditors, with the Directors' approval. As regarded the profit and loss account, the Directors would have been extremely glad if they could have declared a final dividend on the trading of the year; but they very much regretted that it was impossible to do so. He concluded by moving the adoption of the report.

Mr. C. J. HEGAN seconded the motion.

Mr. SLADGE regarded the report as very unsatisfactory; and asked whether, if the present should prove a good year, the balance of the past year's dividend would be made up to them. He thought the Directors ought to have made the arrangement earlier with the other Gas Companies as to fixing the price charged to private consumers by a sliding scale.

Mr. WOOLLEY inquired what the effect would be upon the Company of the *moratorium*.

The CHAIRMAN, in reply, stated that the Directors gave most anxious thought to the question of collecting the outstandings; and a man was constantly engaged on the work. It would be very dangerous to cut off the gas in such a city. With regard to the *moratorium*, the news had only come by telegraph; and he could not give any definite information as to what it meant. The Directors thoroughly sympathized with the shareholders at the non-receipt of a dividend this time; and they would be very glad if circumstances allowed them to pay one next year. They could not, however, foretell what the premium on gold would be; and therefore he could not say what their position would be in the coming year. The agreement referred to with the other Gas Companies in Buenos Ayres had been under discussion some time; but there had been a good many initial difficulties, which had only recently been surmounted.

The motion was then unanimously adopted; and the retiring Director (Mr. Hegan), and the Auditors (Messrs. Tribe, Clarke, Painter, and Co.) were re-appointed.

The usual complimentary votes terminated the proceedings.

**The Oil Lighting at Bromley to be Discontinued.**—It is now practically settled that the oil lighting at Bromley, Kent, is to be abandoned, and that the thoroughfares in which the experiment has been made shall be lighted with gas.

**Messrs. H. Balfour and Co.**, of the Durie Foundry, Leven, N.B., have been entrusted with the contracts for purifiers, roofs, and retort fittings for the Ramsgate Corporation Gas-Works, tenders for which were invited in our advertisement columns a few weeks ago.

## CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held last Thursday, at the Offices, Commercial Road, Pimlico—Sir W. H. WYATT in the chair.

The SECRETARY (Mr. G. H. Gill) read the notice calling the meeting, and the report of the Directors was taken as read.

The GOVERNOR, in moving the adoption of the report, stated that the past half year had been a most anxious time for the Directors. In the first place, the unexampled severity of the winter—unexampled, at least, in recent years—had caused them considerable anxiety and trouble. The supply of water was stopped in a great many places, not through the Company's pipes, but through the consumers' pipes, being frozen. This had involved the erection of a large number of stand-pipes, which were a cause of great annoyance. They had, however, passed through this difficulty pretty well. An extra item appeared in the accounts this half year of £2000 on this account, which had to come out of what would otherwise have been available for dividend. He hoped they would not have such a severe time again; but if they did, perhaps they would see some better mode of getting over the trouble. To come to a more serious matter, the inquiry before Parliament, probably the shareholders would like to hear a great deal about it; but he regretted to say that he could not tell them much, because the Committee had so changed and shifted about from one point to another, that it was impossible for anyone to tell what they would or would not do next, and really they knew very little more about it than before the inquiry commenced. The only satisfactory feature was this, that they did not impugn the quality or the quantity of the water. All that was said was that they might not have enough water in twenty years' time. If, however, the Companies were left alone, they would provide the quantity that might be necessary; but no one could tell what might happen in twenty years. What the result of the inquiry would be, they could not tell; but he thought it was quite certain that there would be no legislation this session. The Committee might report, recommending a scheme to be brought forward for some future time; but this was a question of doubt. In the meantime, the Directors were spending the proprietors' money very freely. They could not help this; for they were obliged to employ counsel, and to be prepared in every way. Their scientific witnesses were in attendance day by day; but they had not yet been called, and they would have to be paid. They knew that the expenses which they would have to bear through the inquiry would be heavy; but the outlay would be completely wasted, as no good would result from it. However, it would no doubt be satisfactory to the proprietors to know that the position of the Company was not impugned, either as to the quality or the quantity of the water they supplied; and they would be able to show, if the chance were afforded them, that the charges of the London Water Companies were very much below those of provincial companies, or in provincial towns where the Corporations undertook the supply.

Mr. COOPER inquired the approximate expenses of the Company, observing that he had heard that they were £1000 a day for the eight Companies.

The GOVERNOR, continuing, said he could not tell what the cost was; but he thought the sum mentioned was not unlikely.

Mr. COOPER said he had heard that the amount which the Grand Junction Company had to pay was estimated at £150 a day.

The GOVERNOR, resuming, stated that this was the figure which the Chairman at the meeting of the Grand Junction Company had mentioned as the expense to which that Company was put, exclusive, however, of the general expenses. The outlay was heavy; but it was a matter over which the Directors had really no control, as it had been forced upon them. They had joined with the West Middlesex Company, whose expenses they shared; and this was better than having to bear all the outlay themselves. Several wild schemes had been propounded; but whether or not they would come to anything he did not know. What they wanted was to be left alone. They had a splendid property; and they much preferred the security which it afforded them to that of the amalgamated rates. These might be perfectly safe; but they would rather hold their own property. If Parliament said that the ratepayers must have control over it, then, on their part, they said that the ratepayers must give them a just price. If these undertakings were acquired, he was sure the public would pay more for their supply; and if they did not pay for it under the head of water-rates, they would do so in some other way. Moreover, they would not be attended to as they were now, as the Companies had a strong interest in trying to satisfy everyone, and to keep down their expenses, so as to pay a fair dividend. When it became a public concern, no one would care anything about it, and they would not have men who understood it as the Directors of the present Companies did. The quinquennial valuation had taken place; and it would most assuredly result in the Company having to pay many hundreds a year more for rates; but whether they received any increased revenue themselves was more than doubtful. It was impossible to say until next half-year's accounts were made up; but he believed there were more reductions than increases. No doubt, some of the property had gone up. He was not speaking of cases where a £40 house had been pulled down and a £400 house erected in its place. This, of course, was an advantage to them. He was speaking of existing houses when he said there was no increase.

Mr. COOPER: Supposing the water undertakings are transferred, would the Water Authority, whoever it might be, enforce these rates, as is now done against the private Companies?

The GOVERNOR: I believe they would do away with the rates.

Mr. COOPER: So do I.

The GOVERNOR: If they do, it must throw heavier charges on the ratepayers, because we pay very large sums in rates. I think I have said before that we pay about 1s. 9d. out of every pound for parish rates; and in the case of some of the Companies, the proportion is, I believe, larger than that. Continuing, the Governor observed that they must go on as before, and do the best they could. He was glad to say that they had made a better contract for coal, which would probably reduce the price about 2s. 6d. per ton, and this was an important item. In their last report, they mentioned that they proposed to give the staff a small gratuity; it being the first time that the proprietors had obtained their 10 per cent. The staff had been extremely gratified with it; and he hoped they might be able to continue it. They had allotted the rest of the 4½ per cent. preference stock; and now all the capital they had left was about £70,000 in debenture stock. He did not see any reason why they should want this for two or three years; and what might happen in that time they did not know.

The DEPUTY-GOVERNOR (Mr. F. S. Clayton) seconded the motion, which was at once unanimously carried.

A resolution was afterwards passed providing for the payment of the preference dividend due on the 5th prox.

The GOVERNOR then proposed that a dividend be declared for the half year ended March 31 last at the rate of 10 per cent. per annum on the ordinary capital stock, less income-tax.

The DEPUTY-GOVERNOR seconded the motion.

The GOVERNOR, in reply to a question, stated that, if they could do so, they would certainly be entitled to pay the dividends in arrear in past years. This amount was very large; for sometimes the Company did not pay 2 per cent. They must not, however, be too anxious at present in regard to this matter.

The motion was carried unanimously.

The retiring Directors and Auditor were subsequently re-elected; and a vote of thanks to the Governor and Directors concluded the meeting.

## SEVILLE WATER-WORKS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held at the London Offices, No. 86, Cannon Street, E.C., last Thursday—Mr. DAVID EVANS in the chair.

The Directors reported that the income from all sources during the year ending March 31 last amounted to £26,755; and, after deducting working expenses, the cost of laying on services, and debenture interest, the net revenue was £8111. Adding to this the balance of undivided profit brought forward—viz., £17,530, and after charging the contribution to the sinking fund of £526, and the two half-year's dividends up to Sept. 30, 1890, the amount remaining to the credit of the profit and loss account was £11,976. The Directors recommended that a dividend, at the rate of 4 per cent., free of income-tax, be paid for the past half-year; making with the 5 per cent. interim payment, a dividend for the year of 4½ per cent., which would absorb £5362, and leave £6614 to be carried forward.

The CHAIRMAN, in moving the adoption of the report and accounts, said that this was the first year the Board were able to place before the shareholders a real profit and loss account. Hitherto, as they were aware, the Company received from Messrs. Easton and Anderson (the leaseholders) a rental of £21,000 per annum; and it simply devolved upon the Directors to make a distribution of 5 per cent. to the shareholders on their capital. Messrs. Easton always placed at the Company's disposal the figures of the books which were kept by them to show the cost of working and the progress of the concern under their management; but the analysis did not permit of a comparison with the analysis as submitted by the Auditors. The profit and loss account showed that the apparent increase of water-rental for 1890-91 as compared with 1889-90 was only £110, and such an increase, if it were real, would be most disappointing. The figures that the Directors presented at the last meeting were given to them by the leaseholders. The calculations were made on a basis of 25 pesetas to the £1 sterling, and had there been no need of remitting the money to England, this would have been correct. The Auditors, however, took as the basis of their conversion of pesetas into sterling 26·50 to the £1—a very important difference. Hitherto the interest on debentures had been 6 per cent.; but the Company's income was now so assured that the Directors intended to at once give the six months' notice to reduce the interest to 5 per cent. free of income-tax. He also mentioned that the Directors were going to make immediate application for a quotation on the Stock Exchange.

Mr. E. HORNER seconded the motion, which, after a short discussion, was unanimously carried.

The retiring Directors and Auditors were re-elected; and the proceedings then terminated.

**The Vyrnwy Water-Works.**—The great balancing reservoir at Oerley Hall, above the town of Oswestry, which receives from the mouth of Llanforda tunnel the water from Lake Vyrnwy on its way to Liverpool, and which was recently emptied in order that it might be stored with a fresh supply, is now being rapidly replenished; and Mr. W. Davies, the Resident Engineer, states that there is already amply sufficient water in it for the supplementary supply to Liverpool through the temporary pipe-line laid across the bed of the Mersey. The reservoir is connected with a series of filter-beds, which are the largest in the kingdom. These are now in full working order; and so far as they have been tested, appear to answer admirably the purpose for which they were designed. They are at present three in number; and each measures 400 ft. by 180 ft.—the depth being 7 ft. 6 in. They are divided from each other by a depth of about 50 feet; and in these spaces and along the north side of the beds, there are underground pipes, by means of which the water may be passed through all or any of the beds straight on to Liverpool. Two of the filter-beds were in operation last Saturday week; and the depth of water in them was 2 ft. 6 in. As they continue to be used, the effect of the purifying process upon the water will become more perfect; the accumulated impurities being got rid of even before passing through the filter-beds. With reference to the aqueduct under the River Mersey, it may be here mentioned that, owing to the slow progress which is being made with the work, and the difficulties that are being encountered by the contractors, the Water Committee last Tuesday decided to recommend the Council to retain Mr. Deacon as Consulting Engineer for a further period of six months. Last Thursday week the connection was made complete of the temporary pipe across the River Mersey at Fiddler's Ferry; and the permanent main pipe on the Lancashire shore. The water from Lake Vyrnwy can now be sent through to Prescot.

## NOTES FROM SCOTLAND.

**From our Edinburgh Correspondent.**

EDINBURGH, *Saturday*.

The annual meeting of the Dundee Gas Commission passed off very harmoniously on Wednesday; and the report of the proceedings reads bravely in the newspapers. I have already referred to the prosperous nature of the Commission's business, for which I frankly admit that they deserve all the credit that can be given to a public body. It is evident that they are not afraid to take the populace into their confidence more freely than is the case (say) in Edinburgh; but yet, as I read it over, I feel that there is a defect in the statement which Mr. J. Mitchell gave. He tells us, for instance, nothing as to the cost price of gas; or, to put it another way, as to the on-cost in the manufacture. Neither is there anything in his address regarding the rate of wages current in the works, and whether they are up or down. The whole is taken up with reference to the price they pay for coal, the quantity of gas they get from the coal, the amount, in a lump, they expect for coke and residuals, &c.; but nothing is stated separately, so that an analysis of the accounts is impossible. These items were possibly all in the accounts supplied to the Commissioners, but they have not been given to the public; and the public are the parties interested, not, with all due deference to the body, the Commissioners themselves. It is all very well to crack up a few of the outstanding features of the business, and to lump a number of things together, and say that the total revenue or expenditure will be such and such. Why not—and I do not write this of Dundee, but of all Commissioners, for Dundee gives more information than most—give an account of the business which could be followed, and which would show where matters were going forward and where they were going backward? In the case of Dundee, for instance, I have tried to calculate how the surplus of £392 is to be realized at the end of the current year; but I have failed. The Commissioners have, and I think very wisely, a liberal scale of discounts, which affect the revenue to a considerable extent; how much, one may search Mr. Mitchell's statement in vain to find out. Differential rates are charged by the Commissioners; yet not only are the amounts derived from the different rates not given, but the amounts derived from the sale of gas and from meter-rents are not differentiated. All these are subjects which should not have been left out, as their absence makes it impossible to know how matters are really going on. There seems to be a fear of giving too much information to the vulgar public—a feeling which I do not share. A business which is flourishing as is that of the Dundee Gas Commission does not require any concealment. In fact, I am convinced that the freer and fuller it is laid before the public the more prosperous it will be; because the public will then take an interest in it, which they cannot do when they only receive a sort of hotch-potch explanation of how things stand. The present practice of reserved communications can only foster the belief, which is too prevalent, that there are "ways that are dark" about all gas undertakings. I do not believe there are; and the best way to dispel such notions would certainly be to show the whole hand of the Commissioners at these annual meetings. Instead of sitting in conclave and endeavouring to convince themselves, the Commissioners should set themselves to convince the public all is well.

Speaking on the subject of "Moulding: Its Application to the Arts," before the Edinburgh Association of Science and Arts on Monday night, Mr. Thomas Blaikie pointed out the peculiar circumstance that since the introduction of gas for street lighting there had been no advance in the designs of the pillars for street lamps which are in use in Edinburgh; and he condemned the plain fluted design because of its lack of variety.

The accounts of the Edinburgh Water Trust for the past year show very satisfactory results. There was an estimated expenditure for the year of £83,895; and so carefully was this estimate adjusted, that it is found the actual expenditure was £83,669, or £226 less than the estimate. On the revenue side the estimate was £82,953; and the actual receipts, £86,101—an increase of £3148. The domestic rate—at 6d. per £1, to which it was reduced from 6½d. last year—yielded £48,225, an increase of £2470 over the estimated rates; and there is stated to be irrecoverable a sum of £1245. Meter and shipping rates yielded £34,775, or £1650 over the estimate. The property account, which is stated at £1,146,874, has been increased by £128,057 during the year; but of that sum £15,294 is recoverable from the Water of Leith Purification and Sewerage Commissioners.

As in their gas undertaking, the Corporation of Dundee have had a highly prosperous year in their water undertaking. Estimating for an income of £40,565, they have received £43,217; or, with a surplus of £2651 from the previous year added, £45,868. Of this sum the domestic rate produced an increase of £502, and the special rates an increase of £2048, nearly the whole of which was derived from meter-rates. Their total expenditure, including £2625 placed to the sinking fund, was £42,978; which was £21 above the estimate. They have, on the year, however, a surplus of £2889; which was described by Bailie Craig at the annual meeting last Saturday as the largest surplus he had ever declared. During the year they added £5447 to their borrowed funds, and paid off £3600 of debt. Bailie Craig regretted that no good had yet resulted from their efforts to obtain a reform of the mode of assessing water-works; and he pointed to this anomaly in the present system, that next year they will require to raise a larger revenue to meet an increased payment to the sinking fund, and, the assessment being upon revenue, they will be assessed on a higher figure, although not a penny will have been added to the value of their works. Rates and taxes were last year estimated at £3460; but it required a sum of £3527 to meet all claims. It is expected the rates will be fixed the same as last year.

An action to recover damages for slandering a town is a legal novelty. Such an action has been raised in the Aberdeen Sheriff Court, by the Police Commissioners of Banchory against A. Duncan, timber merchant, Innescairnie, in which the sum of £500 is sued for in respect of statements published by Duncan in letters to newspapers. The inhabitants of the town derive a large part of their maintenance from the letting of apartments to summer visitors; and the Police Commissioners consider that they will suffer serious loss by the published statement that the town is "a fair field for infectious diseases, and a happy breeding-ground for poisonous microbes." The slanders complained of were written with reference to the water supply of the town, which the Commissioners say is of first-rate quality. The defence is that the statement is true.

In the course of laying new gas-mains in George Street, Edinburgh, the workmen have recovered four pieces of wooden pipes which had been used for the conveyance of the North Pentland water to the inhabitants of the new town of Edinburgh when it was first introduced. The pipes are in a good state of preservation, and show well the method of jointing them, which was effected by simply thinning down one end of the pipe and letting it into the widened opening of the other pipe.

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**From our Glasgow Correspondent.**

GLASGOW, *Saturday*.

The forthcoming annual meeting of the North British Association of Gas Managers, which is to be held in Edinburgh next month, under the presidentship of Mr. R. Robertson, of the Bathgate Gas-Works, promises to be a great success. Papers have been promised by Mr. John West on stoking machinery, by Mr. G. R. Hislop on some phases of the gas-burner question, by his assistant (Mr. Love) on regenerative firing of retorts, and by other gentlemen. Messrs. Hepworth, Valon, and Veevers have applied to be admitted as members; and they are expected to be present in person, with the view of showing a friendly feeling between The Gas Institute and the North British Association.

I do not claim that the following data regarding the Glasgow gas coal contracts for the year 1891-2 are official; but, considering the sources whence they have been obtained, they may be regarded as being generally very near the truth. The first purchases for the year have this time been made somewhat earlier than has been the practice within the past few years, which may result in a financial benefit to the Gas Trust. It is said that Mr. Foulis estimates the year's wants for Glasgow and "Greater Glasgow" to be about 410,000 tons of coal; and it is believed that the Contracts Committee had offers of somewhere about 900,000 tons out of which to make their purchases, which had amounted to close upon 300,000 tons. Report has it that nearly all the so-called "splint parrot" coals offered were declined, unless in those cases where the advance in price was very small. The splint coals proper were offered in very great quantity; and in most cases the price asked ranged, off and on, 8s. 6d. per ton, and some were bought at the low cost of 8s. 2d. per ton. Last year at the second contracting time very much higher prices had to be paid for splints—in some cases even 2s. per ton more. The rich cannel coals in a number of instances have been advanced in price as much as from 5s. to 7s. 6d. per ton beyond the rates asked last year. I am told on good authority that the average price of the coals purchased is, as near as may be, about 6d. per ton above last year's average. A list of quantities supplied to me by one of my informants shows that in no fewer than seven instances the lots purchased amounted to 30,000 tons each. There is only one really big lot of fairly rich cannel named in my list of acceptances—that of Cairntable, 30,000 tons. The others are generally for small lots—from 1000 up to 6000 tons. An "outside" report states that about 100,000 tons of last year's contracts had still to be delivered; but from another source, I learn that the amount is not more than 70,000 tons.

At the annual meeting of the Largs Gaslight Company held this week, it was resolved to increase the price of gas from 4s. 7d. to 5s. per 1000 cubic feet. The Muirkirk Gaslight Company, however, have resolved to continue the price of gas at 4s. 7d. per 1000 feet; and so they may, considering the fact that their dividend is 10 per cent., and does not seem likely to come below that level.

At last Monday's monthly meeting of the Stirling Town Council, the alleged unwarranted increase in the price of gas was again under consideration. A minute was submitted from the Lighting Committee, which stated that the Committee were of opinion that the intended increase in the price was not warranted; and they recommended that the Gas Company should be asked to reconsider their decision. They were also of opinion that the Clerk should be requested to get particulars as to the price of gas and its illuminating power in towns similar in size to Stirling. Ex-Bailie Lawson (Convener of the Committee), in moving approval of the minutes, said that the Committee deprecated the rise of 5d. per 1000 feet in the price of gas. He was not in a position to state what would be the exact amount of the increase on the gross supply to the town; but when the accounts were corrected they would be able to state that the rise on one class of lamps was 3d.; on another class, 7d.; and on another, 10d. He had learned—but he was open to be corrected by any person present who was interested in the Company—that the Gas Company were paying the price of the new gasholder, which was something like £1000, out of profits. They were not only paying a large percentage to the shareholders, but they were adding to capital, and thus increasing the price of the shares; so that they were piling on the amount for any future time when the Council might acquire the gas-works. He would like to know if the Committee had power to interview the Directors of the Gas Company or not. Provost Yellowlees replied that he was not at the last meeting of the Council; but he thought that the Committee should certainly be empowered to meet the Directors or open correspondence with them with the view of ascertaining whether or not they were to reconsider their resolution to raise the price of gas. A considerable amount of discussion took place on the subject; and in the course of it some remarks were made by Bailie Kinross, who expressed his wish to dissent from the minute submitted by the Lighting Committee. Ex-Dean of Guild Mercer also dissented; and the Provost remarked that he could not endorse the minute. He was quite willing to accept it as the Committee's opinion, but not as the Council's. Eventually the minute was approved; and the matter was continued in the hands of the Committee, with full powers to endeavour to get the price of gas reduced.

An extraordinary general meeting of the shareholders of the Falkirk Joint-Stock Gas Company was held on Thursday afternoon—ex-Provost Cockburn presiding. The meeting confirmed the resolution adopted by the extraordinary general meeting held on the 2nd inst., giving authority to increase the borrowing powers to £8000. The meeting also had under consideration the question of the Burgh Commissioners' attitude towards the laying of pipes in the streets; and it was agreed

that should the Commissioners or the County Council not grant terms favourable in connection therewith, the Company should apply to Parliament for permission to open the streets for the purpose of putting down pipes. The advisability of erecting or forming new works, was discussed; and it was thought to be inexpedient at present to proceed with such an undertaking.

The business in Scotch pig-iron warrants this week has been the smallest for many years. This is said to be due to the action of the London Syndicate. Several additional furnaces have been put in blast this week. The price of Scotch iron has ranged between 47s. on Monday, 48s. on Thursday, and 47s. 3d. per ton yesterday.

Very little change has taken place during the week in the position of the local coal trade. Gas and splint sorts are in brisk inquiry; and the shipments have been above the average. For main coal the price is 3d. per ton easier.

## CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June 20.*

**Sulphate of Ammonia.**—The market remains unimpressionable; and there is very little movement; but, in order to effect clearances, £10 16s. 3d. has been accepted for some parcels. In one or two instances, even £10 15s. is reported to have been taken for small lots. It seems, however, unless one mistakes present symptoms, as if the lowest point had now been touched, and that at all events next month a better state of things may be expected. The demand from consumers has been so unprecedentedly small, that it is but natural to conclude that their stocks must now be at a low ebb, and that they cannot put off new purchases much longer. Nitrate is a shade steadier, without alteration in value.

LONDON, *June 20.*

**Tar Products.**—This market continues lifeless, and without feature. All the products, excepting pitch, are weaker. It is thought that benzol has reached the bottom for the present; but buyers hold aloof. Makers, however, are pretty well sold; and the production is just now small. No new business of any importance is reported in this article. Anthracene is offering without finding buyers, excepting for very good quality. Carbolic acid is not in request, as is usual at this time of the year. The price continues very low indeed. Tar products are reported at prices ranging from 23s. to 27s. To-day's prices of products are: Pitch, 34s. to 35s. Benzol, 90's, 3s. 8d.; 50's, 2s. 8d. Toluol, 1s. 7d. Solvent naphtha, 1s. 4½d. Crude naphtha, 1s. Creosote, 1¼d. Carbolic crystals, 6d.; crude, 60's, 1s. 3d. Cresol, 8d. Anthracene, "A" quality (nominal), 1s. 4d.; "B" quality, 10½d.

**Sulphate of Ammonia.**—This article appears to be quite demoralized; and although the production to-day is at its minimum, prices are lower, and sales are difficult. The outlook is far from encouraging; and, unfortunately, sulphate is an article that lends itself readily to the operations of middlemen. Prices have ruled from £10 15s. to £11 per ton, less discount, according to position and delivery. Gas liquor, 5s. to 6s.

## THE LANCASHIRE GAS COAL TRADE.

**From Our Own Correspondent.**

Negotiations with regard to several of the more important gas coal contracts in this district are still pending; but the smaller contracts are gradually being settled pretty much the same with regard to prices as those I have referred to in previous reports. The basis on which tenders have been sent out seem to have settled down generally to a concession of about 6d. per ton upon the prices obtained last year—in fact, in some instances, colliery proprietors at the very outset appear to have recognized this as the basis on which business would have to be transacted this year, and have tendered straight away at 6d. under the rates which they obtained upon similar contracts for last season. Others have not been so ready to give way, and have endeavoured to split the difference, with the result that, in certain cases, the concessions have not exceeded 3d. per ton. But it seems likely that the bulk of the gas coal which will be placed this year will be at 6d. below last year's rates; and for good screened gas coals 10s. per ton remains the average figure at the pit mouth, although there are inferior sorts at 6d. less. In the contracts for locomotive fuel, which are fixed generally about this time of the year, railway companies are obtaining very considerable concessions—ranging from 1s. to 1s. 3d. per ton upon the prices they had to pay last year. I understand that the London and North-Western Railway Company have settled considerable contracts on the basis of about 8s. per ton for locomotive fuel at the pit mouth; while contracts with other companies are under negotiation at about 8s. 6d. per ton. Last year the prices obtained averaged 9s. to 9s. 3d.; and in some cases 9s. 6d. per ton. I also hear that in the Yorkshire district contracts for locomotive fuel are being placed at 10s. per ton, as compared with 11s. and 11s. 3d. last year. In other branches of the trade, there is a more or less general quietening down in the demand, which is only to be expected at this season of the year, with prices showing less firmness. At several of the Lancashire collieries reductions of 6d. per ton are being made on some descriptions of round coal; and although there is no actual giving way in prices generally, the tendency of the market is certainly in the favour of buyers, and there is a disposition on the part of colliery proprietors in many instances to contract forward at the reduced rates now current. Considering, however, that little or no coal has so far been put down into stock, and that the miners will surely so regulate the output as to prevent any excessive surplus supplies which shall have the effect of weakening their position with regard to wages, any very general giving way in prices is scarcely to be anticipated. Some of the colliery-owners are altogether disinclined to commit themselves to heavy forward engagements; as they anticipate the possibility of a decidedly firmer tone with the close of the year, owing to the absence of the usual stocks which accumulate during the summer to meet the increased winter requirements. At the pit mouth, best Wigan Arley coals are still averaging fully 12s. per ton; second qualities of Arley, fetch 10s. 6d. to 11s.; Pemberton 4-feet coals, 10s. to 10s. 6d.; common house fire coals, 9s. to 9s. 6d.; and steam and forge coals, 7s. 9d. to 8s. 6d. Engine classes of fuel continue plentiful; and although the better descriptions are moving away without much difficulty, commoner sorts are a general drug in the market, and are pushed for sale at excessively low figures. At the pit mouth, burgy ranges according to quality from about 6s. 9d. to 7s. 6d. per ton; good qualities of slack, 5s. 6d. to 6s.; with common sorts readily obtainable at 3s. 9d. to 4s. 6d. per ton.

**Northern Coal Trade.**—The coal trade of the North-east has been a little firmer. Local race holidays will interfere with the production for three or four days; and there has been a desire to ship coal away before the holiday. Best steam coal is, however, rather easier in price at some of the collieries; and from 12s. 6d. to 12s. 9d. may now be given as the current price. Second kinds and small coals are rather easier, also; and correspondingly lower prices are accepted, though most of the pits have full work for a week or two ahead. Gas coals are now at the time of the lowest consumption. But there is a fair export; and as the rates of freight to London are low, coal is being rather freely shipped there, and probably will be soon shipped much more rapidly. Contracts for many gas companies are in the market; and one or two local ones have been concluded—in nearly all cases at a reduction of about 1s. per ton on the rates that prevailed eight or nine months ago. The tenders for the supply for the Middlesbrough Gas-Works are sent back for revision by the Committee—they are varying in price from 10s. 6d. to 11s. 6d. per ton delivered. Bunker coals are quiet; and household coals are very flat—the warm weather having interfered with the consumption of the latter. For manufacturing coal, there is a good demand; and coke is also steadier, owing to the enlarged use in the north-west. Gas coke is unaltered.

**Gas Cookery Lectures at Warrington.**—From Monday to Friday of last week, Miss H. M. Young delivered a course of practical lectures on cooking by gas at the Co-operative Hall, Warrington. In connection with the lectures was an exhibition of the various gas appliances manufactured by Messrs. T. Fletcher and Co., of that town.

**The Quality of the Commercial Company's Gas.**—At the Worship Street Police Court on Thursday last, the Commercial Gas Company were summoned, before Mr. Lushington, by the London County Council, for supplying, at their testing-station in the Parnell Road, Old Ford, gas of a lower illuminating power than is permitted by their Acts. Mr. Young appeared for the Company, and did not contest the facts. On behalf of the Council, it was said that the tests made on the 3rd and 6th of January last showed the gas to be below the illuminating power to the extent of 0·5 candle on the first date, and 0·4 of a candle on the second date. The penalty for 0·5 candle was 40s.; and there was no less penalty for a less deficiency, but a much heavier one for every fraction beyond the first half candle. Mr. Young said the Company had considerable trouble during the winter months in keeping the pipes free from deposit; and he submitted that this was one of the "unavoidable causes" which a Magistrate was empowered by the Act to take into consideration. If allowed on this occasion, the Company would not be thought to be liable; but, at least, he asked the Magistrate not to impose the full penalty. Mr. Lushington replied that to a Gas Company the penalty of 40s. was a very mild one; and he saw no reason, in the present instance, for reducing it. He fined the Company 40s. for each day named, with 25s. costs.

**The Public Lighting of Kingswood.**—This question (which was referred to in the JOURNAL a fortnight ago) again came before the members of the Kingswood Local Board last Wednesday. The Clerk (Mr. S. F. Andrews) mentioned that the Bristol Gas Company had written to the effect that they were prepared to adhere to their previous offer, made in April, to undertake the supply of gas at 2s. 10d. per 1000 cubic feet. Three tenders had also come to hand from electric companies; but one of these had not complied with the conditions laid down by the Board. The other two were Messrs. Parfitt and Son, of Keynsham, and Messrs. Christy and Son, of Chelmsford. The former firm offered on a seven years' contract 140 lamps, of 25 indicated candle power, at £3 11s. 8d. per lamp per annum; 20 lamps, of 125-candle power, at £7 5s.; and 4 lamps, of 250-candle power, at £14—a total of 164 lamps, at £698 13s. 4d. Messrs. Christy stipulated for five years; the number of lamps to be not less than the equivalent of 150 lamps of 30-candle power each. Their prices were £2 10s. per annum for each lamp of 15-candle power, £3 5s. for 24-candle power, £4 for 30-candle power, and £5 10s. for 48-candle power. It was thought by the members that it would be advisable to visit a district where Messrs. Christy had already the responsibility of the public lighting; and it was agreed to write to the firm to this effect.

**Abandonment of Electric Lighting at Barnet.**—After a three-years' trial of electric lighting, with results with which our readers have been made acquainted from time to time, the Barnet Local Board, at their meeting last Tuesday, decided to revert to gas lighting. The Barnet District Gas Company, in response to an invitation, sent in a tender to light the district with 136 lamps for £465 per annum; and the Lighting Committee of the Board, who had had before them an offer from an electric lighting company in South Wales for the same number of incandescent electric lamps, recommended that the Gas Company's tender be accepted. The matter gave rise to a long discussion at the meeting of the Local Board; but, although some of the members seemed to regret losing the light which had caused them so much trouble, they did not feel inclined to pay for this "luxury" from £100 to £150 more than they will have to pay for gas. The *Barnet Press*, commenting on the subject last Saturday, said: "The decision causes little surprise, for, to put it mildly, the electric light has not been so successful as some expected it would be; while the cost to the town has been much heavier than was the cost of the system of gas lighting which it for a time superseded. The most sanguine could never have regarded the lighting of the town with electricity as other than an experiment; and, like many another experiment, it did not realize expectations." We should think not.

**Gas Exhibition at Landport.**—During the past week Mrs. J. B. Thwaites, the Principal of the International School of Cookery, Liverpool, delivered a series of lectures on cooking by gas at the Albert Hall, Landport. In connection therewith, was a capital show of gas appliances for cooking and general domestic purposes.

**Gas Exhibition at Matlock Bridge.**—Last week an exhibition was held at Matlock Bridge, under the auspices of the Matlock Bridge and District Gas Company. The exhibitors were Messrs. Unsworth and Richmond, Limited, who showed their new "Model" range in various sizes; Messrs. John Wright and Co., Limited; the Wenham Company, Limited; and Messrs. J. Stott and Co. Lectures were given daily by Miss Geddes, of the Yorkshire School of Cookery. The exhibition was opened by Dr. Harrison, the Chairman of the Company; and an interesting address was given by Mr. E. W. T. Richmond on "Gas as a Domestic Servant."

**Burslem Corporation Gas Accounts.**—At the last meeting of the Burslem Town Council, the Chairman of the Gas Committee (Mr. Hulme) made a statement as to the financial results of the working of the department during the past year. He said that the receipts had amounted to £20,796, against £17,250 in the previous year. The expenditure had been £18,499, against £14,277 9s. 4d.; being an increase of £4221. So far as the receipts for gas were concerned, the amount received this year was £15,611, against £13,088; making an increase of £2523. The amount, however, was absorbed by the increased expenditure for coals; the excess being £2565. In 1879, when the works were taken over by the Council, the consumption of gas was 70 million cubic feet per year, and now it had risen to 103 million feet. There had been a large increase in the expenditure for renewals of plant; the amount for the past year having been £4899, as against £2843—being an increase of £2056. This had been met by increased receipts from residuals of £1377, and the decrease in profit of £675.

**The Stockton Corporation and the Gas Workers.**—Yesterday week, a demonstration was held in the Exchange Hall, Stockton, under the auspices of the Trades' Council, for "the purpose of laying before the working men of the town, the indignity which has been placed upon the workers and toilers, through their local parliament of labour, by the Gas Committee of the Corporation, who have persistently refused to recognize that labour has any right to take any active part in the management of town affairs. Mr. J. Green, the President of the Trades' Council, who presided, stated that the gas workers were affiliated with the Trades' Council; and therefore what was their grievance was the grievance of the Council. It, however, was not so much now a grievance of the gas workers as between the labouring population of Stockton and their representatives in the Council who had treated them with disdain. However, the November elections would come on; and they intended to heckle would-be candidates and, as at Leeds, let the elections turn on the gas question and the rights of working men to combine for mutual assistance. Mr. W. Storey, of the Amalgamated Society of Engineers, moved—"That this meeting is of opinion that the action of the Gas Committee of the Stockton Town Council in refusing to meet a deputation of the Trade and Labour Council, *re* the dismissal of workmen from the Corporation gas-works, is detrimental to the interests of good and sound local government; and, further, we are of opinion that a Sub-Committee from the Town Council should be appointed to confer with a Sub-Committee from the Trade and Labour Council to investigate the alleged charges." In speaking to the motion, he stated that six men were discharged for holding unionist principles. The Gas Committee said it was because they had lost time; but the men were prepared to go before any tribunal to substantiate their allegations. The motion having been seconded, Mr. Mark Hutchins, the President of the Gas Workers' Union, and others addressed the meeting, and the motion was unanimously carried.

## GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 1230.)

| Issue. | Share | When ex-Dividend. | Dividend or Div. & Bonus. | NAME. | Paid per Share | Closing Prices. | Rise or Fall in Wk. | Yield upon investment. |
|---|---|---|---|---|---|---|---|---|
| £ | | | p. c. | GAS COMPANIES. | | | | £ s. d. |
| 500,000 | 10 | 10 Apl. | 10½ | Alliance & Dublin 10 p. c. | 10 | 16½—17½ | +½ | 6 0 0 |
| 100,000 | 10 | „ | 7½ | Do. 7 p. c. | 10 | 11½—12½ | .. | 6 0 0 |
| 300,000 | 100 | 2 Jan. | 3 | Australian (Sydney) 5 % Deb. | 100 | 100—106 | .. | 4 12 7 |
| 100,000 | 20 | 28 May | 8 | Bahia, Limited | 20 | 14—16 | .. | 10 0 0 |
| 200,000 | 5 | 13 May | 7½ | Bombay, Limited | 5 | 6¾—7 | .. | 5 7 1 |
| 40,000 | 5 | „ | 7½ | Do. New | 4 | 4½—5½ | .. | 5 14 1 |
| 380,000 | Stck. | 26 Feb. | 12½ | Brentford Consolidated | 100 | 420—225 | +3 | 5 8 10 |
| 125,000 | „ | „ | 9½ | Do. New | 100 | 160—164 | +1½ | 5 12 10 |
| 220,000 | 20 | 12 Mar | 11½ | Brighton & Hove Original | 20 | 40—42 | .. | 5 9 6 |
| 320,000 | 20 | 10 Apl. | 11½ | British | 20 | 43—45 | .. | 5 0 0 |
| 50,000 | 10 | 12 Mar. | 11 | Bromley, Ordinary 10 p. c. | 10 | 18—20 | .. | 5 10 0 |
| 39,000 | 10 | „ | 8 | Do. 7 p. c. | 10 | 13—15 | .. | 5 6 8 |
| 328,750 | 10 | 13 Nov. | 6 | Buenos Ayres (New) Limited | 10 | 7¼—8½ | +½ | — |
| 200,000 | 100 | 2 Jan. | 6 | Do. 6 p. c. Deb. | 100 | 95—100 | .. | 6 0 0 |
| 150,000 | 20 | 26 Feb. | 8 | Cagliari, Limited | 20 | 25—27 | .. | 5 18 6 |
| 550,000 | Stck. | 10 Apl. | 13½ | Commercial, Old Stock | 100 | 255—265 | .. | 5 3 9 |
| 130,000 | „ | „ | 10½ | Do. New do. | 100 | 195—205 | .. | 5 4 10 |
| 130,000 | „ | 30 Dec. | 4½ | Do. 4½ p. c. Deb. do. | 100 | 121—120 | .. | 3 11 5 |
| 557,320 | 20 | 11 June | 13 | Continental Union, Limited | 20 | 47—49* | .. | 5 6 2 |
| 242,680 | 20 | „ | 13 | Do. New '69 & '72 | 14 | — | .. | — |
| 200,000 | 20 | „ | 10 | Do. 7 p. c. Perf. | 20 | 37—38* | .. | 5 5 3 |
| 75,000 | Stck. | 25 Mar. | 10 | Crystal Palace District | 100 | 200—205 | .. | 4 17 7 |
| 486,090 | 10 | 28 Jan. | 4† | European, Limited | 10 | 20½—21½ | .. | — |
| 354,060 | 10 | „ | 4† | Do. Partly paid | 7½ | 15—16 | +½ | — |
| 5,470,630 | Stck. | 12 Feb. | 13 | Gaslight & Coke, A, Ordinary | 100 | 233—236 | —1 | 5 9 2 |
| 100,000 | „ | „ | 4 | Do. B, 4 p. c. max. | 100 | 96—99 | .. | 4 0 9 |
| 665,000 | „ | „ | 10 | Do. C, D, & E, 10 p.c. Pf. | 100 | 255—260 | .. | 3 16 11 |
| 30,000 | „ | „ | 5 | Do. F, 5 p. c. Prf. | 100 | 120—125 | .. | 4 0 0 |
| 60,000 | „ | „ | 7½ | Do. G, 7½ p. c. do. | 100 | 175—180 | .. | 4 3 4 |
| 1,300,000 | „ | „ | 7 | Do. H, 7 p. c. max | 100 | 160—164 | .. | 4 5 4 |
| 463,000 | „ | „ | 10 | Do. J, 10 p. c. Prf. | 100 | 253—258 | .. | 3 17 6 |
| 476,000 | „ | „ | — | Do. K, 6 p. c. Prf. | 100 | 154—158 | .. | 3 16 0 |
| 1,061,150 | „ | 11 June | 4 | Do. 4 p. c. Deb. Stk. | 100 | 112—115* | .. | 3 9 7 |
| 294,850 | „ | „ | 4½ | Do. 4½ p. c. do. | 100 | 120—125* | .. | 3 12 4 |
| 908,000 | „ | „ | 6 | Do. 6 p. c. do | 100 | 163—168* | .. | 3 11 5 |
| 3,800,000 | Stck. | 13 May. | 12 | Imperial Continental | 100 | 223—228 | .. | 5 5 3 |
| 75,000 | 5 | 12 Dec. | 6 | Malta & Mediterranean, Ltd. | 5 | 4¾—5¼ | .. | 5 14 3 |
| 560,000 | 100 | 1 Apl. | 5 | Met. of Melbourne, 5 p. c. Deb. | 100 | 110—112 | .. | 4 9 3 |
| 541,920 | 20 | 11 June | 6½ | Monte Video, Limited | 20 | 17½—18½* | .. | 7 0 6 |
| 150,000 | 5 | 28 May | 10 | Oriental, Limited | 5 | 8¾—9¼ | .. | 5 8 1 |
| 60,000 | 5 | 25 Mar. | 7 | Ottoman, Limited | 5 | 4—5 | .. | 7 0 0 |
| 166,870 | 10 | 26 Feb. | 2 | Pará Limited | 10 | 3—4 | .. | — |
| 420,000 | 100 | 4 May | 6 | People's Gas of Chicago—1st Mtg. Bds. | 100 | 92—97 | .. | 6 3 9 |
| 500,000 | 100 | 1 June | 16 | 2nd Do. | 100 | 90—95 | .. | 6 6 4 |
| 150,000 | 10 | 28 Apl. | 10 | San Paulo, Limited | 10 | 15—16 | .. | 6 5 0 |
| 500,000 | Stck. | 26 Feb' | 15½ | South Metropolitan, A Stock | 100 | 282—287 | .. | 5 8 0 |
| 1,350,000 | „ | „ | 12 | Do. B do. | 100 | 237—242 | .. | 4 19 2 |
| 166,500 | „ | „ | 13 | Do. C do. | 100 | 242—250 | .. | 5 4 0 |
| 678,000 | „ | 30 Dec. | 5 | Do. 5 p. c. Deb. Stk. | 100 | 141—145 | .. | 3 9 0 |
| 60,000 | 5 | 12 Mar. | 11½ | Tottenham & Edm'nton, Orig. | 5 | 11—13 | .. | 4 8 5 |
| | | | | WATER COMPANIES. | | | | |
| 729,281 | Stck. | 30 Dec | 10 | Chelsea, Ordinary | 100 | 260—270 | .. | 3 14 1 |
| 1,720,560 | Stck. | 10 Apl. | 8 | East London, Ordinary | 100 | 212—217 | .. | 3 13 9 |
| 544,440 | „ | 30 Dec. | 4½ | Do. 4½ p. c. Deb. Stk. | 100 | 140—145 | .. | 3 2 0 |
| 700,000 | 50 | 11 June | 8 | Grand Junction | 50 | 108—112* | .. | 3 11 5 |
| 708,000 | Stck. | 12 Feb. | 10½ | Kent | 100 | 265—270 | .. | 3 17 10 |
| 1,043,800 | 100 | 30 Dec. | 9½ | Lambeth, 10 p. c. max. | 100 | 240—245 | .. | 3 17 7 |
| 406,200 | 100 | „ | 7½ | Do. 7½ p. c. max. | 100 | 197—202 | .. | 3 14 3 |
| 260,000 | Stck. | 25 Mar. | 4 | Do. 4 p. c. Deb. Stk. | 100 | 118—123 | .. | 3 5 0 |
| 500,000 | 100 | 12 Feb. | 12½ | New River, New Shares | 100 | 347—352 | —1 | 3 8 10 |
| 1,000,000 | Stck. | 28 Jan. | 4 | Do. 4 p. c. Deb. Stk | 100 | 125—128 | .. | 3 2 6 |
| 902,300 | Stck. | 11 June | 6½ | S'thwk & V'xhall, 10 p. c. max. | 100 | 167—171* | .. | 3 16 0 |
| 126,500 | 100 | „ | 6½ | Do. 7½ p. c. do. | 100 | 160—165* | .. | 3 18 0 |
| 1,155,066 | Stck. | 11 June | 10 | West Middlesex | 100 | 250—260* | .. | 3 16 11 |

* ex div.

† Interim dividend.


GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON." **GWYNNE & CO.,** TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 30,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.

Catalogues and Testimonials on application at the above address.

Only 75 Revolutions per Minute.

The above Engraving shows Two Engines driving Four GWYNNE & CO.'S PATENT NON-FLUCTUATING EXHAUSTERS to pass 200,000 cubic feet per hour (without the slightest oscillation), at the EFFINGHAM STREET GAS-WORKS, SHEFFIELD.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

*NO OTHER MAKER CAN DO THIS.*

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

**NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.**

**Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.**


OXIDE OF IRON.

**O'NEILL'S Oxide has a larger annual** sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

**ANDREW STEPHENSON** Agent for the GAS PURIFICATION AND CHEMICAL COMPANY, Ltd., Palmerston Buildings, LONDON, E.C.

**ANDREW STEPHENSON,** Agent for BRIN'S OXYGEN COMPANY, Limited, Westminster, S.W.
City Address: 182, Gresham House, Old Broad Street, LONDON, E.C.

CANNEL COAL, ETC.

**JOHN ROMANS & SON, EDINBURGH.** Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH; NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

**TAR and Liquor wanted.** BROTHERTON AND CO., Commercial Buildings, LEEDS.

**DRAWINGS, Tracings, Specifications,** Quantities, &c., prepared by an experienced Engineering Draughtsman. Plans of Works made, copied, or enlarged. Blue copies made. Illuminated Addresses in first-class style. Writings of all kinds, Engrossments, &c.
Address ENGINEER, 173, FENTIMAN ROAD, S.W.

**A YOUNG Man,** having a thorough knowledge of Tar Distilling, and having the command of Two or Three thousand pounds, desires a PARTNERSHIP.
Address, in first instance, No. 1964, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**ADVERTISER** (age 21) desires an engagement as MANAGER of medium-sized Works, or ASSISTANT at Large Works. Well up in Distribution, Purification, and Carbonization. Practical acquaintance with Modern Gas Apparatus. Highest references.
Apply to No. 1965, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**TRAVELLER** (Practical) requires extra Commission from a Gas Engineer or Stove Manufacturer. At present selling Regenerative Lamps, covering London, South Coast, and Eastern Counties. Small salary, half expenses, and commission.
Address No. 1963, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, a Gas-Meter Repairer.** To a competent man, good wages will be given.
Apply, stating age, qualifications, and references to the MANAGER, Gas-Works, DRIGHLINGTON.

GAS STOKER.

**WANTED, a good steady man.** One used to Shovel Charging preferred. Wages 26s. 3d. per week. To a good man the job will be permanent.
Apply to the MANAGER, Gas-Works, BRITON FERRY.

**WANTED, a single man as Manager** of small private Gas-Works in North Wales. Must be capable of repairing Gas and Water Pipes in house and establishment without assistance. Wages 28s. per week, and free lodging.
Apply to Hafodunos, Abergele, NORTH WALES.

**WORKING FOREMAN wanted—age** between 30 and 40—for a Gas-Works in the South of England making about 60 millions per annum. Must be a good mechanic, competent to do ordinary repairs to the various machinery, the fitting up of retort-benches, understand retort setting, and have a thorough knowledge of the working of a Gas Plant throughout. Also competent to take charge during the absence of the Manager. Wages 35s. per week, with cottage on Works.
Applications to be sent, not later than the 27th inst., to No. 1962, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**WANTED, a Cast-Iron Tank,** in good order, to hold about 100,000 gallons.
Quote lowest price f.o.r. or f.o.b., with sketch of Tank, and approximate time of delivery, to No. 1956, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

**ON SALE—A Saw Bench, 4 ft. by 2 ft.** (Robinson's); displaced by larger Bench. Also a good GAP LATHE.
Apply to T. PROUD, 103, Icknield Street, BIRMINGHAM.

**JAMES LAWRIE & CO.** supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

**W. C. HOLMES & Co., Huddersfield,** AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gas-holders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 1276 of this week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

**J. & J. BRADDOCK,** Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock, Oldham."

TUBES.

**FOR Gas, Steam, and Water; Galvanized,** White Enamelled, and Hydraulic Tubes, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

**COZE'S Automatic Apparatus for** CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 1092.
Inquiries should be addressed to THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED, 86-88A, LEADENHALL STREET, E.C.

**RAILWAY Tanks for Hire or Sale.** Address BROTHERTON AND CO., Ammonia and Tar Distillers, LEEDS.

RAMSGATE CORPORATION GAS AND WATER DEPARTMENT.

**FOR SALE—A set of Second-hand** ANNULAR CONDENSERS, 10-inch Connections. Outside Tube of Wrought Iron, 30 inches diameter; inside Tube of Cast Iron, 16 inches diameter. Valves and Bed Plate complete. All in good order.
For particulars apply to
WILLIAM A. VALON, Engineer.

HORIZONTAL PIPE CONDENSER.

**THE Directors of the Staines and Egham** Gas Company, Limited, invite TENDERS for the supply and delivery at the Company's Works at Egham, of a 10-inch HORIZONTAL PIPE CONDENSER.
Plan and specification may be seen, and all particulars obtained, on application to the Company's Manager, Mr. Thomas Webb, at the Works.
Tenders, stating time within which the delivery can be made, to be sent to the undersigned not later than the 1st of July next.
JOHN ANTHONY ENGALL, Solicitor and Secretary.
Staines, June 19, 1891.

CORPORATION OF MOSSLEY.
(GAS DEPARTMENT.)

**THE Gas Committee are prepared to** receive TENDERS for the surplus TAR produced at the Gas-Works during the Nine months ending the 25th of March, 1892.
Particulars and form of tender may be obtained on application to the Manager (Mr. R. Merrell).
Sealed tenders to be sent to the Town Clerk, endorsed "Tar," not later than the 6th of July.
The Committee do not bind themselves to accept the highest or any tender.
By order,
JOSEPH HYDE, Town Clerk.

CORPORATION OF MOSSLEY.
(GAS DEPARTMENT.)

**THE Gas Committee are prepared to** receive TENDERS for the supply of 6500 tons of GAS COAL, and 100 tons of CANNEL.
Sealed tenders to the Town Clerk, endorsed "Gas Coal," not later than noon of the 6th of July.
Particulars and form of tender may be obtained on application to the Manager (Mr. R. Merrell).
The Committee do not bind themselves to accept the lowest or any tender.
By order,
JOSEPH HYDE, Town Clerk.

TENDERS FOR GAS COALS.

**THE Directors of the Westerham Gas** and Coke Company, Limited, invite TENDERS for a Year's supply of about 500 tons of the best screened GAS COALS, delivered at Westerham Station, in quantities to suit the convenience of the Directors.
Tenders, stating the description, and endorsed "Tender for Coals," to be sent to the Office of the Company on or before Wednesday, the 1st of July.
The Directors do not bind themselves to accept the lowest or any tender.
By order,
CHARLES HOOKER, Secretary and Manager.
Westerham, Kent.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

**BALE, BAKER, & CO.,** direct Importers from Ireland. Sample and Price on application.
OXIDE PAINT, SULPHURIC ACID, & Chemicals.
120 and 121, NEWGATE STREET, LONDON, E.C.

SULPHURIC ACID.

**JOHN NICHOLSON & SONS,** Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

**JOHN RILEY & SONS,** Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

**HUTCHINSON BROTHERS,** Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

**OXIDE OF IRON.** Genuine Natural Bog ORE. QUALITY AND CONDITION GUARANTEED. Any quantity supplied at lowest rates.
D. M. NELSON AND SONS, GLASGOW. Telegraphic Address: "Gas Glasgow." Depôts throughout England and Scotland.

**SADLER AND CO., LIMITED,** MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 70, Wellington Street, GLASGOW; 58, Fountain Street, MANCHESTER; and 96, Reade Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

BOROUGH OF NELSON.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

**THE Gas Committee invite Tenders for** the supply of about 13,000 tons of screened GAS COAL, to be fresh and of the best quality, free from all Dirt, Bats, Pyrites, and all other Impurities, and delivered in monthly quantities, as the Committee may require, free at the Lancashire and Yorkshire Railway Siding, Nelson, or at the Leeds and Liverpool Canal Wharf.
Particulars of deliveries, and any further information, may be had of the Manager, Mr. Wm. Foster.
Tenders, under seal, endorsed "Tender for Gas Coal," to be sent to me, the undersigned, not later than the 30th inst.
By order,
R. M. PRESCOTT, Town Clerk.
Town Hall, Nelson,
June 15, 1891.

BOROUGH OF NELSON.

**THE Gas Committee of the Corporation** of Nelson are prepared to receive TENDERS for the purchase and removal from their Works of two WROUGHT-IRON TOWER SCRUBBERS, (internal dimensions 33 ft. by 5 ft. 6 in. diameter), filled with ½-inch boards. Water Spreaders, 10-inch Valves, and Connections all complete. To be sold cheap. Can be seen at any time on the Works.
Tenders, under seal, endorsed "Tender for Tower Scrubbers," to be sent to the undersigned as early as possible.
By order,
R. M. PRESCOTT, Town Clerk.
Town Hall, June 16, 1891.

**THE Directors of the Clevedon Gas** Company, are prepared to receive TENDERS for the supply of 500 to 2000 tons of screened GAS COAL or NUTS, to be delivered at the Clevedon Station during the next Twelve months.
Also for the supply of 15 tons of the best OXIDE OF IRON.
Tenders to be addressed to the Chairman of the Company on or before the 30th of June next.
SAMUEL DAWES, Manager.
Clevedon Gas-Works, June 20, 1891.

CIRENCESTER GAS COMPANY, LIMITED.

**THE Directors are prepared to receive** TENDERS for the supply of from 2000 to 3000 tons of best screened GAS COAL, delivered free to the Watermoor Station of the Midland and South-West Railway Company during the Twelve months ending June 30, 1892, at such times and in such quantities as the Manager may direct.
Tenders, marked "Tender for Gas Coal," to be delivered at the Company's Offices, 12, Silver Street, Cirencester, on or before the 2nd day of July next.
No special form of tender.
JOHN P. BEECHAM, Secretary.
Cirencester, June 13, 1891.

THE Directors of the Kildwick Parish Gas Company invite TENDERS for a supply of the whole or part of 2500 tons of best screened GAS COAL or NUTS, to be delivered free at Kildwick, during the Twelve months ending July 31, 1892.

The Coal to be delivered at such times and in such quantities as the Manager may direct.

Tenders to be sent in not later than the 6th of July next, addressed to the "Chairman," and endorsed "Tender for Gas Coal."

The lowest or any tender not necessarily accepted.

FRED. H. PICKLES,
Manager and Secretary.

Gas-Works, Kildwick,
June 9, 1891.

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CITY OF CARLISLE.

TENDERS FOR COAL AND CANNEL.

THE Carlisle Gas Committee are prepared to receive TENDERS for the supply of about 15,000 tons of Screened or Unscreened GAS COAL, and about 4000 tons of CANNEL, to be delivered at their Works in Carlisle, in such quantities as may be directed, from July, 1891, to June, 1892.

Tenders specifying the description of the Coal or Cannel, the pits at which they are raised, and the terms for net monthly payment, are to be sent on or before July 7, 1891, endorsed "Tender for Coal."

J. HEPWORTH,
Engineer and Manager.

Gas-Works, Carlisle,
June 4, 1891.

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CITY OF CARLISLE.

TAR CONTRACT.

THE Carlisle Gas Committee are prepared to receive TENDERS for the surplus TAR to be produced at their Works, for a period of One or more years from the 30th of June next.

Any further particulars required can be obtained upon application to the Engineer, to whom sealed Tenders, endorsed "Tender for Tar," must be delivered on or before July 7, 1891.

The Committee do not bind themselves to accept the highest or any tender.

J. HEPWORTH, Engineer.

Gas-Works, Carlisle,
June 4, 1891.

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BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 5500 tons of GAS COAL.

Conditions and form of tender may be had of the Manager (Mr. F. C. Humphrys), at the Gas-Works, Rutland Street, Ilkeston.

Sealed endorsed tenders must be delivered to the undersigned by Five o'clock in the afternoon of Thursday, the 25th day of June inst.

The Committee do not bind themselves to accept the lowest or any tender; and they reserve the right to divide the quantity above-named into two or more contracts.

By order,
WRIGHT LISSETT.

Town Hall, Ilkeston,
June 12, 1891.

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BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the surplus TAR made at their Gas-Works for a period of One year.

Tenders, properly endorsed, must be delivered to the undersigned by Five o'clock in the afternoon of Thursday, the 25th day of June inst.

The Committee do not pledge themselves to accept the highest or any tender.

Full particulars and form of tender can be obtained of the Manager at the Gas-Works.

By order,
WRIGHT LISSETT,
Town Clerk.

Town Hall, Ilkeston,
June 12, 1891.

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TO BUILDERS AND CONTRACTORS.

THE Sheffield United Gaslight Company invite TENDERS for constructing an INNER LINING to the existing GASHOLDER TANK, 156 feet diameter by 30 feet deep, at their Grimesthorpe Station. The lining will consist of a Brick, Stone, and Asphalte Wall and Bottom.

Drawings and specification may be seen, and form of tender with bill of quantities obtained, on application to Mr. Fletcher W. Stevenson, the Company's Engineer, on payment of One Guinea, which will be returned on receipt of a *bond fide* tender.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders must be delivered, addressed to the undersigned, on or before Monday, the 6th day of July next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
June 17, 1891.

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TO IRONWORK CONTRACTORS.

THE Sheffield United Gaslight Company invite TENDERS for the supply and erection of Eight PURIFIER COVERS, 27 ft. 4 in. by 19 ft. 11 in., and for taking down, removing, and refixing Three Covers 18 ft. 7 in. square.

Copies of the drawings and specification may be obtained from Mr. Fletcher W. Stevenson, the Company's Engineer, on payment of 10s. 6d.

The Directors do not bind themselves to accept the lowest or any tender.

Sealed tenders must be delivered, addressed to the undersigned, on or before Monday, the 6th day of July next.

HANBURY THOMAS,
General Manager.

Commercial Street, Sheffield,
June 17, 1891.

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NORTHWICH GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply of good GAS COAL and CANNEL for One year ending June 30, 1892.

The quantity required will be about 2900 tons of Coal, and 150 tons of Cannel.

Sealed tenders, stating price per ton, delivered in Gas Company's or Colliery Wagons at Northwich Railway Station, or in Barges alongside the Gas Company's Works on the River Dane, endorsed "Tender for Coal" or "Cannel," and addressed to the Chairman, must be sent in here not later than the 26th of June inst.

Any further particulars required may be had on application to Mr. S. S. Mellor, Manager.

The lowest or any tender not necessarily accepted.

HENRY PICKERING,
Secretary.

Gas-Works, Northwich,
June 11, 1891.

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NORTHWICH GAS COMPANY.

THE Directors of the above Company invite TENDERS for the supply and delivery at the Northwich Railway Station of best BUXTON LIME for Gas Purification purposes; also for BROWN OIL OF VITRIOL, free from Arsenic, for One year ending June 30, 1892.

Further particulars can be had on application to Mr. S. S. Mellor, Manager.

Sealed tenders, endorsed "Lime" or "Vitriol," and addressed to the Chairman, must be sent in here not later than June 26 inst.

The lowest or any tender not necessarily accepted.

HENRY PICKERING,
Secretary.

Gas-Works, Northwich,
June 11, 1891.

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TO COLLIERY PROPRIETORS AND OTHERS.

THE Corporation of Stafford are prepared to receive TENDERS for the supply of 12,000 tons of COAL suitable for Gas Making purposes, to be delivered at the London and North-Western or Great Northern Stafford Stations, during the Twelve months ending July 31, 1892.

Forms of tender, together with any further information, may be obtained from Mr. J. F. Bell, Gas Engineer, Stafford.

Tenders, sealed, and endorsed "Tender for Gas Coal," to be sent to me not later than Twelve noon on Saturday, the 27th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON,
Town Clerk.

---

RIVER BRIDGE.

THE Corporation of Stafford are prepared to receive TENDERS for the supply and erection of IRONWORK, &c., for RAILWAY BRIDGE over the River Sow, adjoining their Gas-Works.

Drawings may be seen, and copy of specification obtained, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "River Bridge," to be sent to me not later than Twelve noon on Saturday, the 27th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON,
Town Clerk.

---

IRON ROOF.

THE Corporation of Stafford are prepared to receive TENDERS for the supply and erection of the IRONWORK, &c., for a ROOF, 58 feet span, over the Retort-House now being erected at their Gas-Works.

Drawings may be seen, and copy of specification obtained, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "Iron Roof," to be sent to me not later than Twelve noon on Saturday, the 27th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON,
Town Clerk.

---

LATTICE GIRDER.

THE Corporation of Stafford are prepared to receive TENDERS for the supply of one LATTICE GIRDER, 61 ft. long by 5 ft. 6 in. deep, to be delivered at their Gas-Works.

Drawing may be seen, and copy of specification obtained, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "Lattice Girder," to be sent to me not later than Twelve noon on Saturday, the 27th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON,
Town Clerk.

---

GASHOLDER.

THE Corporation of Stafford are prepared to receive TENDERS for TELESCOPING a GASHOLDER at their Gas-Works.

Drawings may be seen, and copy of specification obtained, on application to Mr. J. F. Bell, Engineer, Gas-Works, Stafford.

Tenders, sealed and endorsed "Gasholder," to be sent to me not later than Twelve noon on Saturday, the 27th inst.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
MATT. F. BLAKISTON,
Town Clerk.

---

EASINGWOLD GASLIGHT AND COKE COMPANY, LIMITED.

THE Directors are prepared to receive TENDERS for the supply of 300 tons of GAS COAL, to be delivered at Aine Station, or at Easingwold Station, during the Twelve months succeeding the 1st of August next, in such monthly quantities as may be required.

Tenders must state terms for both stations as above and be sent, together with an analysis of the Coal, to Mr. F. E. Rookledge, Honorary Secretary, on or before July 1.

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TO COAL CONTRACTORS AND OTHERS.

THE Sedgley Local Board invite Tenders for supplying 500 to 1000 tons of GAS COAL, the deliveries to be made at Shut End Siding, at such times and in such quantities as may be directed.

Sealed tenders, marked "Coal," to reach me on or before the 8th of July next.

The Board do not bind themselves to accept the lowest or any tender.

By order,
JOSEPH SMITH,
Clerk to the Board.

High Holborn, Sedgley,
June 16, 1891.

---

TENDERS FOR COAL.

THE Corporation of Batley are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 16,000 tons of GAS COAL.

Conditions and forms of tender may be obtained on application to the Manager at the Gas-Works.

Sealed tenders, addressed to me, and endorsed "Gas Coal," to be delivered at my Office by noon on Monday, the 29th of June inst.

The Corporation do not bind themselves to accept the lowest or any tender, and may accept any tender for a part only of the specified quantity.

J. H. CRAIK,
Town Clerk.

Town Clerk's Office, Batley,
June 19, 1891.

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TENDERS FOR COAL.

THE Directors of the Higham Ferrers Gas Company invite TENDERS for the supply of 400 tons of best screened GAS COAL, to be delivered at the London and North-Western Railway Company's Station, Higham Ferrers, between Aug. 1, 1891, and July 31, 1892.

Tenders to be delivered by July 11, endorsed "Tender for Coal," and addressed to W. Hirst Simpson, Esq., Solicitor, Higham Ferrers.

The Directors do not bind themselves to accept the lowest or any tender.

JNO. T. LEWIS,
Engineer to the Company.

Gas-Works, Wellingborough.

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TENDERS FOR COAL.

THE Directors of the Irthlingborough Gas Company invite TENDERS for the supply of from 300 to 400 tons of best screened GAS COAL, to be delivered at the London and North-Western Railway Company's Station, Higham Ferrers, between Aug. 1, 1891, and July 31, 1892.

Tenders to be delivered by July 11, endorsed "Tender for Coal," and addressed to John Saxby, Esq., Chairman, Gas Company, Irthlingborough, Higham Ferrers.

The Directors do not bind themselves to accept the lowest or any tender.

JOHN T. LEWIS,
Engineer to the Company.

Gas-Works, Wellingborough.

---

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO IRONFOUNDERS.

THE Gas Committee are prepared to receive TENDERS for 6-inch, 8-inch, and 10-inch Plain Socket and Spigot PIPES, 9 feet long exclusive of Socket. Weights not to exceed for 6-inch, 90 lbs.; 8-inch, 130 lbs.; 10-inch, 170 lbs. per yard.

Also PRICES per cwt. for IRREGULARS.

Tenders, stating price per ton delivered free at Stockport Station, to be sent in under seal, endorsed "Tender for Pipes," and addressed to the Chairman of the Gas Committee, on or before Thursday, June 25 inst.

The Committee do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained on application to the Engineer, Mr. S. Meunier, Millgate Gas-Works, Stockport.

WALTER HYDE,
Town Clerk.

Stockport, June 13, 1891.

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TENDERS FOR GAS COAL.

THE Gas Committee of the Newry Town Commissioners invite TENDERS for the supply of from 2800 to 3500 tons of GAS COAL, to be delivered in such quantities as may be required by the Committee, and delivered free *ex* Ship or Steamer at Albert Basin, Newry.

The Coal to be fresh wrought and free from Clench, Pyrites, or other objectionable matter for Gas making.

The Committee would assist the Contractor by allowing him to deliver about 1500 tons of Coal prior to the middle of October next.

Further particulars may be obtained from Mr. A. Gibb, Manager.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal and where raised, to be addressed to the Chairman, Gas Office, Kilmorey Street, Newry, and delivered not later than Thursday evening, the 2nd of July next.

The Committee reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
JOHN KERNAGHAN, Secretary.

Gas Offices, Newry,
June 19, 1891.

TAR AND AMMONIA WATER.

**THE Directors of the Matlock Bath Gas-**light and Coke Company invite TENDERS for surplus TAR and WATER, together and separately, for One year, from the 30th of June, 1891.

Full particulars can be obtained on application to Mr. J. Reeds.

By order,
A. CLARK, Secretary.

June 4, 1891.

---

**BOROUGH OF BURTON-UPON-TRENT.**

RESIDUAL PRODUCTS.

**THE Mayor, Aldermen, and Burgesses** of the Borough of Burton-upon-Trent, acting by the Council, invite TENDERS for the purchase of the AMMONIACAL LIQUOR and surplus TAR to be produced at their Works during Twelve months from the end of July next.

Probable quantity of Coal carbonized during the Twelve months, 22,000 tons.

The Liquor and Tar will be delivered free into Contractor's tank trucks on the Gas-Works Railway Siding.

The strength of the Liquor will be tested by Twaddel's Hydrometer; and persons tendering are requested to state the price per ton to be paid for each ½° of strength from 3½° to 8°.

Payments, net cash, monthly.

Separate tenders for Liquor and Tar, sealed, and endorsed "Tender for Residual Products," are to be delivered to me, at or before Ten a.m. on Saturday, the 27th of June inst.

The highest or any tender will not necessarily be accepted.

F. L. RAMSDEN,
Manager and Engineer.

Gas-Works, Burton-upon-Trent,
June 10, 1891.

---

**GLOUCESTER GASLIGHT COMPANY.**

TENDERS FOR GAS COAL.

**THE Directors of the above Company** invite TENDERS for the supply of 20,000 tons of GAS COAL for One year, from the 1st day of July next, in such monthly quantities as may be required by the Company.

Tenders to state the price delivered at the Midland Railway Wharf, High Orchard, or the Great Western Railway Wharf, Llanthony, Gloucester; or if sent (as preferred) by Water, the price delivered both in Vessel and at the Gas Company's Wharf, on the Gloucester and Berkeley Canal.

Further particulars and forms of tender may be obtained of the Company's Engineer, Mr. R. Morland.

Sealed tenders, endorsed "Tender for Coal," specifying the description and quality of the Coal, to be addressed to the Chairman, Gas Offices, The Quay, Gloucester, and delivered not later than Monday, the 29th day of June inst.

The Directors reserve to themselves the right to accept the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

By order,
WILLIAM E. VINSON,
Secretary.

Gas Offices, Gloucester,
June 4, 1891.

---

**COUNTY BOROUGH OF SALFORD.**

TENDERS FOR GENERAL STORES.

**THE Gas Committee of the Corporation** are prepared to receive TENDERS for the following MATERIALS, in such quantities as may be required, during the Twelve months following the acceptance of Tender, viz.:—

1. Iron and Steel.
2. Tin Sheets, &c.
3. Lead and Composition Pipes, Glass, Pig Lead, &c.
4. Bolts, Nuts, Rivets, &c.
5. Iron Castings.
6. Brass Meter Taps and Keys.
7. Steam Tubing and Fittings.
8. Gas-Meters.
9. Paints, &c.
10. Chandlery.
11. Oils, &c.
12. Cotton Waste.
13. India-rubber Sheetings, Rings, &c.
14. Lias Lime and Cement
15. Timber.
16. Rope, Tarred and Spun Yarn.
17. Haulage.
18. Horse Provender.
19. Veterinary Attendance
20. Brushes and Besoms.
21. Steel Shovels.
22. Lime for Purifying.

Forms of tender, and all further information, may be obtained on application to the Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Miscellaneous Goods," together with sample of goods offered, addressed to the Chairman of the Gas Committee, Town Hall, Salford, must be delivered to me not later than Five p.m. on Thursday, the 9th of July.

By order,
SAML. BROWN,
Town Clerk.

Town Hall, Salford,
June 17, 1891.

---

**THE Directors of the Swindon Gas and** Coke Company, Limited, are prepared to receive TENDERS for the supply of 500 to 1500 tons of best screened GAS COAL delivered free at Swindon, G.W.R. Company's Station, or at the Swindon Town Station of the M. & S.W.J. Railway Company in such quantities as required for the period of One year commencing in the month of July next.

Tenders, endorsed and addressed to the undersigned, to be sent in not later than Saturday, June 27.

The Directors do not bind themselves to accept the lowest or any tender. (No forms of tender provided.)

By order,
H. C. SHEPHERD,
Manager and Secretary.

Gas Offices, Cricklade Road,
Swindon.

---

**SOUTH SHIELDS GAS COMPANY.**

TO COAL-OWNERS.

**THE Directors of the South Shields Gas** Company invite TENDERS for the supply of 40,000 tons of clean unscreened GAS COAL, as required over the next Twelve months, into craft, and at the Company's depôt, South Shields.

The Directors reserve to themselves the right of taking the Coal in one or more lots.

The lowest or any tender not necessarily accepted.

Further particulars may be obtained at the Gas-Works on application to Mr. W. J. Warner, the Engineer.

Sealed tenders to be delivered to the undersigned not later than Friday morning, the 26th inst.

J. H. PENNEY,
Secretary.

Gas Offices, Chapter Row,
South Shields, June 15, 1891.

---

MILLOM LOCAL BOARD.

**TENDERS are invited for the supply of** 1500 tons of GAS COAL, at such times and in such quantities as the Board require during Twelve months from the 1st of July next.

The Coal must be of the best quality, and as free as possible from Bats, Pyrites, and Dross.

Full particulars of the Coal and Colliery and an epitome of the working analysis to be given.

The price per ton delivered free at Millom Station, and (where applicable) at the nearest and most available port to the Colliery or Depôt to be stated.

Sealed tenders (on forms which can be had on application to the undersigned), endorsed "Tender for Coal," to be sent in to me not later than the 12th of July next.

The Board will not be bound to accept the lowest or any tender.

W. T. LAWRENCE,
Clerk to the Board.

Local Board Offices, Millom,
June 18, 1891.

---

TO COAL FACTORS AND OTHERS.

**THE Directors of the Tunbridge Wells** Gas Company will be prepared on Tuesday, the 7th of July, 1891, to receive TENDERS for the supply of 10,000 tons of either NEW PELTON, NEW TANFIELD, EAST PONTOP, SOUTH HETTON, FELLING MAIN, or other approved GAS COALS, at the option of the Directors, to be delivered free on to the Gas Company's Siding on the South-Eastern Railway at Tunbridge Wells, in accordance with terms and conditions which may be obtained on application.

The tenders are to be sent to me by not later than Six o'clock p.m. on Tuesday, the 7th of July, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ,
Secretary.

Gas Company's Office, Tunbridge Wells,
June 23, 1891.

---

CORPORATION OF WARRINGTON.

(GAS DEPARTMENT.)

**THE Gas Committee of the above Cor-**poration invite TENDERS for the supply of about 18,000 tons of COAL and 3000 tons of CANNEL.

Also TENDERS for (*a*) ROTARY EXHAUSTER, with Engine; (*b*) TAR EXTRACTOR; and (*c*) SCRUBBER.

The above to pass 40,000 cubic feet of Gas per hour.

Further particulars can be obtained on application.

Tenders, endorsed "Tender for Coal, &c.," as the case may be, and addressed to the Chairman of the Gas Committee, Gas Offices, Warrington, to be sent in not later than the 2nd of July next.

The lowest tender not necessarily accepted.

N.B.—The Offices will be closed on Friday, the 26th inst.

FREDK. TAYLOR,
Secretary.

Gas Offices, Warrington,
June 8, 1891.

---

FAREHAM GAS AND COKE COMPANY.

**THE Directors invite Tenders for the** supply of 1500 tons (more or less) of best fresh wrought GAS COAL, delivered and metered free into carts at their Wharf at the Works, or free in Contractor's trucks at Fareham Railway Station, in such quantities as they shall from time to time require during the year ending the 30th of June, 1892.

Tenders, specifying the description of the Coals and the pits from which they are to be supplied, to be sent in to me by the 29th inst.

The lowest or any tender not necessarily accepted.

HARRY SMITH,
Secretary.

Gas-Works, Fareham, Hants,
June 23, 1891.

---

**ALTRINCHAM GAS COMPANY.**

SPENT OXIDE.

**THE Directors of the Altrincham Gas** Company invite TENDERS for the purchase and removal of about 150 tons of SPENT OXIDE now lying at their Works.

Samples and any further information can be obtained on application to the undersigned.

Sealed tenders, addressed to the Chairman, to be sent in not later than July 8 next.

The Directors do not bind themselves to accept the highest or any tender.

J. E. LAMB,
Manager.

Gas Offices, Altrincham,
June 19, 1891.

---

BETHESDA.

**THE Bethesda Improvement Commis-**sioners invite TENDERS for the supply of GAS COAL for a period of One year, commencing from the 1st day of August, 1891, to the 31st day of July, 1892, to be delivered at the Bethesda Railway Station in such quantity and at such times as may be required.

The Coal must be of the best of its kind, well screened, and free from Bats, Pyrites, or other Impurities.

Parties tendering must give full information as to the Coal offered, and the Colliery from which they propose to supply; and the tenders to be sent to me not later than the 29th day of June, 1891.

The Commissioners do not bind themselves to accept the lowest or any tender.

R. BENJAMIN EVANS,
Clerk to the Commissioners.

Rachub, near Bangor,
June 13, 1891.

---

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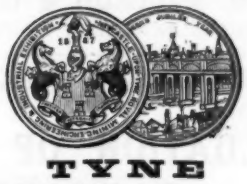

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Coke per Ton, - - - - - - - 57 per cent. of a quality almost equal to that made from the best Coking Coal.
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Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
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Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

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OF ALL FORMS AND SHAPES
IN IRON OR STEEL
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## Under G. R. HISLOP'S PATENTS

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*Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,*

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

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*FOR THE CURE OF STOPPED ASCENSION-PIPES,*

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# AUTOMATIC COAL-GAS RETORTS.

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*THE CHIEF ADVANTAGES CLAIMED FOR THIS PROCESS MAY BE SUMMARIZED AS FOLLOWS:—*

1. **No skilled labour required.**
2. **Wear and tear of carbonizing tools reduced 50 per cent.**
3. **Great reduction in erection of Ascension-Pipes and Hydraulic Mains.**
4. **Coal carbonized one-sixth quicker than by the old process.**
5. **Absolute control of production by unskilled labour.** (This is most important, especially when there is an extra demand for Gas, as in the case of foggy days, &c.)
6. **Fifty per cent. saving in space of permanent Buildings, thus enabling an old Retort-House fitted by this System to manufacture twice the quantity of Gas.**
7. **This System enables the whole of the old Retorts, Doors, Fittings, &c., to be used (if required) where the Morris and Van Vestraut's latest improvements are adopted.** (These improvements were described by Mr. Van Vestraut in his Paper read at the meeting of The Gas Institute in 1890. See JOURNAL for July 8, 1890.)
8. **The Morris and Van Vestraut's System effects a reduction in the cost of carbonizing from 40d. to 10d. (average London prices) per ton of coal, or a saving of more than 70 per cent. in cost of labour.**

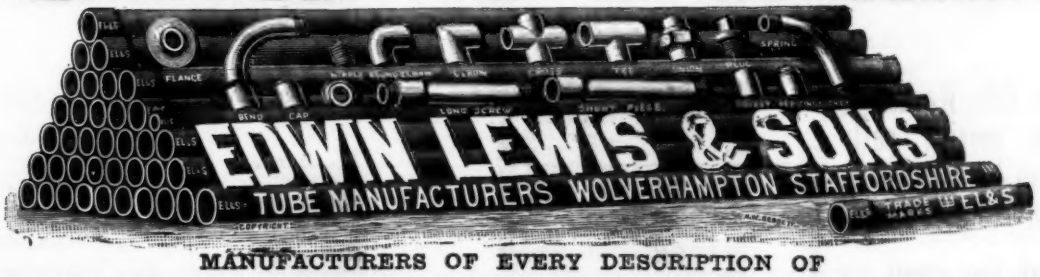
This System of Automatically Charging and Discharging Retorts, without machinery or arduous labour, is being largely adopted at the Works of The Gaslight and Coke Co., the South Metropolitan Gas Co., and the Brentford Gas Co., and of several of the Provincial Gas Companies and Corporations.

**This Process is fully Patented, and any Infringer will be strictly proceeded against.**

For further particulars apply to W. M. KIGHT, Secretary, AUTOMATIC COAL-GAS RETORT COMPANY, LTD. 86 and 88A, LEADENHALL STREET, LONDON, E.C. [See Illustrated Advt., p. 1092.

ESTABLISHED 1825.

# GAS TUBES

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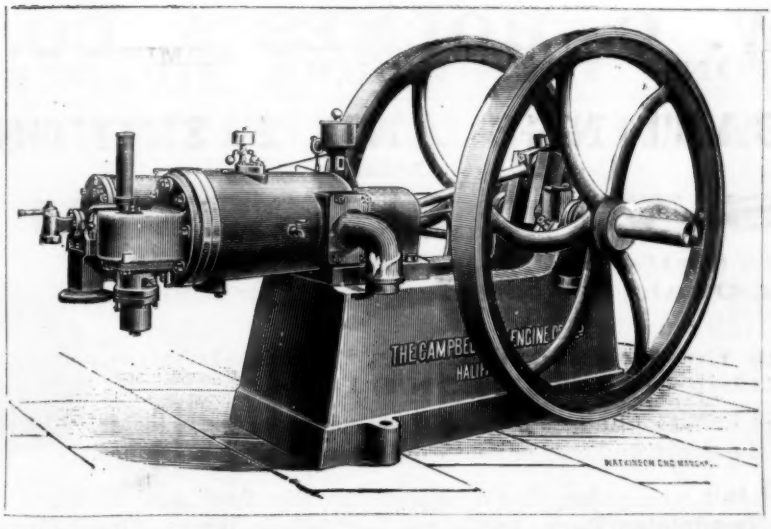

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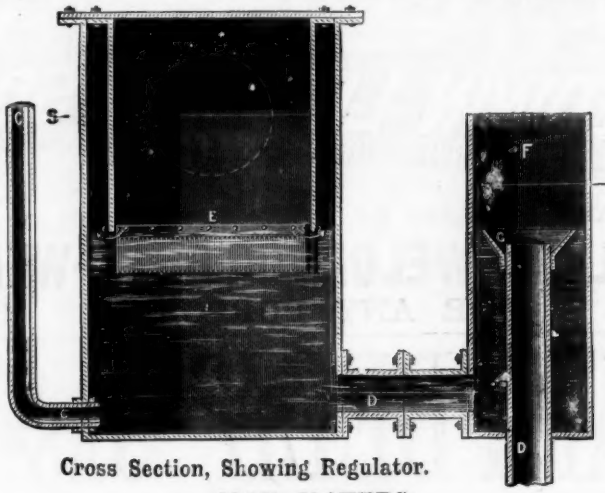
The only Washer without moving parts that can be fixed before an Exhauster.

No more Gas spoilt by over-running the Exhauster.

Perfectly Self-acting.

**Particulars and prices on application.**

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The only safe arrangement to work without Dip.

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No moving parts.

Occupies small space.

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Charging Doors and Frames, Clinker Boxes and Lids complete, Cover Plates and Lids as used at Birmingham and Leicester, and by other Gas Companies.

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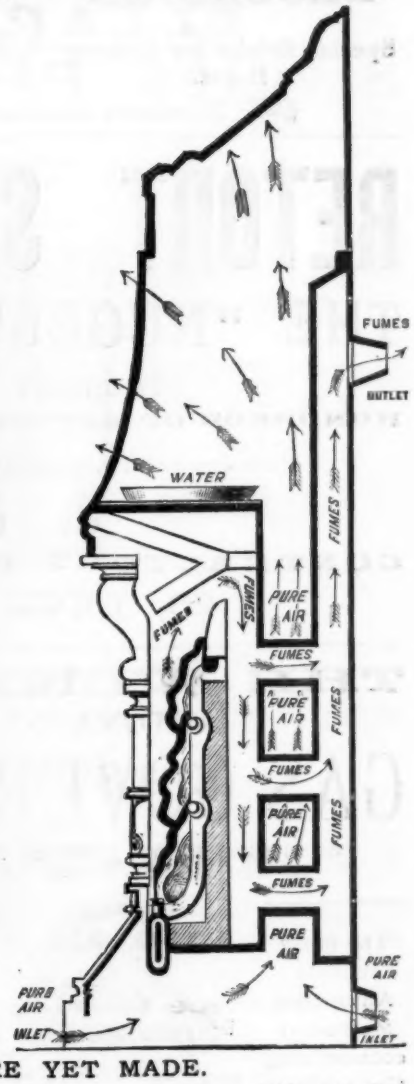


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**HUNDREDS OF SETTINGS WORKING EMINENTLY SATISFACTORY.**

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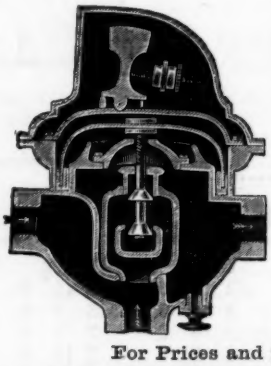
**As supplied to and approved of by H.M. Government.**

**The most reliable Automatic Method of economizing Gas without reducing the Illuminating Power.**



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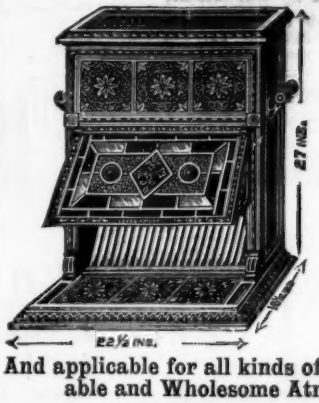


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**THESE STOVES ARE**
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Near LEEDS

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—
1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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PATENTEES
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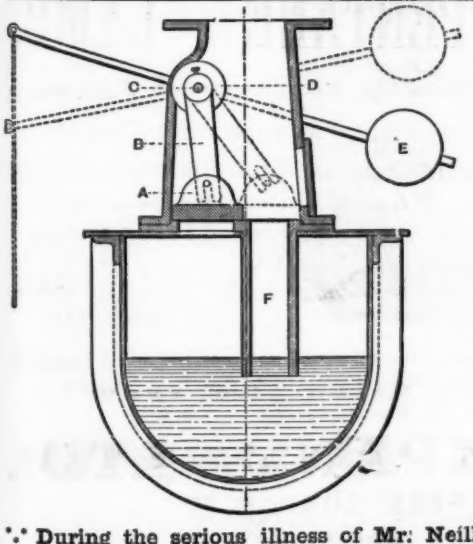


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IMPROVED SLIDE-VALVE ANTI-DIP
Is perfectly reliable in action, and requires no attention.
Has all the advantages of the Dip and Anti-Dip combined.
Is cheap, and easily fixed to any form of main.
Will save more than their cost in one season's working.

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Further particulars from the Sole Patentee and Manufacturer,
NEILL MEIKLEJOHN,
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*** During the serious illness of Mr. Neill Meiklejohn, all communications as to the above should be addressed to C. Meiklejohn, Gas Engineer, Oldbury, near Birmingham.

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By using "CROSBIE'S COMPOSITION," which is absolutely harmless, and the most economical means of preventing Incrustation obtainable. Testimonials on application. Price in casks, 18s. 6d. per cwt., delivered free. Used at the following Gas-Works: Ascot, Birmingham, Broadstairs, Bromsgrove, Hendon, Ilkeston, Kildwick, Knutsford, Leven, N.B., Pembroke, Seaham Harbour, Stamford, Warwick, Wigston, &c., &c., and by leading Engineers throughout the Country.

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*Manufacturers of every description of Gas-Fittings.*

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No putty required.
Glass secured by hinged clips. No loose parts.
A new pane of glass can be fitted in a few minutes by any inexperienced person.
Glass can be supplied cut ready for use.
The frames are not liable to be damaged as in ordinary lamps when hacking out a broken pane of glass.
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They are strongly made, and of best material.

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